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A GENERAL  
TREATISE  
ON VARIOUS COLD  
MINERAL WATERS  
IN ENGLAND.

By Thomas Watson M.D.

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GEORGE A. WATERS



A GENERAL  
T R E A T I S E  
ON VARIOUS  
Cold Mineral Waters  
IN ENGLAND,

But more particularly on those at

HARROGATE, THORP-ARCH, DORST-  
HILL, WIGGLESWORTH, NEVILL-  
HOLT, and others of the like Nature.

W I T H

Their PRINCIPLES, VIRTUES and USES.

A L S O

A Short Discourse on Solvents of the STONE  
in the KIDNEYS and BLADDER.

*A - Short T.*

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L O N D O N:

Printed for the A U T H O R;

And Sold by A. MILLAR, in the Strand; W. OWEN, at  
Temple-Bar; and W. JOHNSTON, in Ludgate-street.

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# ADVERTISEMENT

TO THE

R E A D E R.

**A**S most authors usher in their work with a preface, I did intend to have conformed to custom; but the matter insensibly leading me to too great a length, I then proposed writing an introduction. That also swelling into too great a bulk for the work, I was obliged to turn it into Institutes, for the examination of mineral waters; and, as far as possible to prevent tautologies, gave the several methods of examining the different kinds of them, in order to come at the knowledge of their true contents; and to explain the reasons of their various appearances by the same experiments. But this deluded me into a philosophical chemistry, which was quite beyond my design, and of no service to  
the



vi      A D V E R T I S E M E N T

the generality of readers; and therefore I omitted it, though ready for the press.

Some eminent philosophical chemists of the present age imagine, they have found out all the ingredients, which can possibly enter into the composition of mineral waters, and an easy way to discover what they are, of which I beg leave to give the following specimen.

Vitriolic acid,	{	By applying nitrous acid combined with calcarious earth.
-----------------	---	--

Fossile alcali,	{	By solution of Epsom salt in waters.
-----------------	---	---

Neutral salts by evaporation,	{	Glauber's contain six drachms of water in an ounce; sea-salt decrepi- tates; sal. ammoniac is volatile.
----------------------------------	---	---

Fossil oil                      appears on the surface.

Hepar sulphuris      from the smell.

Me-



Metalline salts, { By coagulating the juice of galls.

Iron, { By applying an alkali, gives a greenish precipitate, changing to a red; copper a blue precipitate; zinc a white one.

Selenites, { The earth is precipitable by fixed, not by caustic volatile alcalis.

Aluminous salts, { They are to be distinguished from magnesia, by taking the precipitate and dissolving it in vitriolic acid.

Earthy salts are { Vitriolic selenites.  
Muriatic selenites.  
Epsom salt.  
Muriatic magnesia.  
Common alum.  
Muriatic alum.

These gentlemen's ingenuity is highly commendable, and presages many noble and useful  
dis-

discoveries; but though their experiments may seem very probable to such as are well acquainted with the laboratory and speculation; yet may be as different from the observations of a practical, judicious experimenter on mineral waters, as are the various kinds of such springs, wherein are found both volatile and fixed parts, in their natural perfection.

A D I S-

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A

DISCOURSE

ON THE

SEVERAL KINDS

OF

Cold Mineral Waters, &c.

HAVING, in the Institutes, proposed several methods for discovering the impregnating principles and contents of mineral waters in general, with more precision than has been done before, and hinted some things, (for amusement to such as have time and opportunity,) which, pursued, might still make the subject more clear and useful; I come next to apply them to practical use on a few waters of somewhat different natures.



*Of HARRIGATE or HARROWGATE.*

AS John Michael Savonarola, who was physician to the Duke of Ferrara, and died in 1431, was the first physician who wrote professedly on baths and mineral waters; so Dr. William Turner, Dean of Wells, in King Edward VI.'s time, (whom the severities of Queen Mary's reign forced upon voluntary banishment into Germany, till better days offered, where he studied physic, and after his return was physician to the Duke of Somerset) was the first Englishman who wrote either on botany or mineral waters. The latter, however, were greatly esteemed in Britain before the incarnation, as appears from the resort then to Bath and Buxton; tho', in those times all being equally strangers to their contents, their use was merely empirical, not rational. Turner wrote on Botany in 1551, and on Bath waters 1560; then Dr. Jones, of King's-mead near Derby, wrote on Buxton in 1572. In this year Dr. Bailey, chief physician to Queen Elizabeth, wrote on Newnham Regis chalybeate water. In James I.'s time came out Dr. Merry on Wellingborough chalybeate. In 1620 Dr. Dean of York wrote on Harrigate chalybeate, and



and was followed by several others, who have treated of the waters, air, and situation of the place. Dr. Neal of Leeds, and his son the late Dr. Neal of Doncaster, attended the place every season for seventy years, tho' the resort of company to it was then but small. Since the last publication on those waters in 1733, great improvements have been made in natural and experimental philosophy in general, and on the subject of mineral waters in particular, especially by the ingenious Dr. Lucas of Dublin; tho' I cannot agree with him in expelling sulphur out of mineral waters. Many of his experiments I had tried twenty years before he wrote, and found them answer; to him and Macquer's chemistry I here acknowledge my obligation, to prevent tautology in frequent quotations.

Harrigate is surrounded with cold mineral waters of different sorts. 1st, The Sweet Spaw, which Dr. Stanhope introduced in 1635 (as nearer Upper Harrigate, and then a better road to it) after the Tuewhet Spaw had been used with great success, above ninety years, but after that neglected, through bad judgment, above 100 years, till 1733, when it was sought, found, and restored to use. 2. Half a mile more west, the Tuewhet Spaw. 3. Half a mile further

west, the Cold Bath. 4. A little north of that, the Stinking Bog. 5. About six hundred yards north of that, down a small descent, the Four Sulphur Wells, altogether on a square coarse pavement. To the west and south west of this, is a thin, clear, healthy, open cold air, from a wholesome, rocky, marshy desert; on the east and north east side, a fine champain, fruitful, plentiful country, fit for all manly exercises, free from whatever is unhealthy, or is offensive to the outward senses, either from land or water. Low Harrigate, about the Sulphur Wells, is all new-built within the last thirty-six years; it lies low, dry, and warm, compassed with small low hills, which deprives it of a prospect. Upper Harrigate lies high, but very cold, has an extensive prospect, is above a mile from the Sulphur Wells, and half a mile from the chalybeate, and four miles from Knareburgh. The Tuewhet Well lies in a wet mossy ground, at the foot of a gentle descent from a small eminence a little above it: under it is soft iron-stone, a shale, and coal. It was formerly a bad road to it, but lately mended; and being a very spirituous water, when brought to the houses, or after standing some hours, it tastes weaker; which made Dr. Stanhope prefer the Sweet Spaw, which is nearer, bears carriage



carriage better to the houses, and retains its volatile principle longer, being far coarser, harsher, is not so agreeable to taste nor stomach, goes not so soon off, nor raises the spirits so much; but neither of them bear carriage or keeping. Both Dr. Bright, and Dr. Hunter of Newark, and Capt. Slingsby, preferred the Tuewhet Well to it. The Tuewhet Well was laid aside before Dr. French examined its water. Had Dr. Stanhope known how to fix instantly its volatile iron, so as to bear carriage, or keeping by sea or land, it had been effete, and reduced to the state of Dr. Hoffman and Dr. Shaw's artificial chalybeate waters.—A good way east of those, lies another antient weaker chalybeate, called St. Mungo's well, with several others, on that vast moor.

About five hundred yards south of the Sulphur Wells lies the stinking, sulphureous, or vitriolic Bog before mentioned, two or three hundred yards long, but not so broad, with its mixture of fresh, common, and vitriolic, black, thick, fœtid waters, which meeting and mixing together on the surface or middle of the Bog, on a sloping descent of gravelly earth, may give some idea of the horrible Stygian lake of the poets, for smell, colour, and consistence. Its stench is so strong, that

travellers going that way, and the wind in their face, may perceive it at a good distance. This place, in antient times, was a vast forest of wood, and here stood great iron forges. This Bog is compassed on all sides by dry, small rising grounds, so as no other springs can get into it, and it has only one outlet from it. These mixed waters in it glide gently on hard ground, which has an easy ascent on each side, that prevents all ingress of other springs or drains getting into the Bog water. It runs softly along an easy, hard, gravelly descent, where it is lost, or swallowed up under a hedge, at the head of some inclosed fields, which on each side rise up into two dry, steep hills of seven or eight yards perpendicular. There the water falls into the crannies of two sorts of stone, (one a bastard lime-stone and free-stone, the other greyish and lighter, somewhat soft) through the chinks and fissures between the layers of those stones, shut up these two hills. It is probably this very water (for it seems filtered for five or six hundred yards,) springs in a very little vale below, between three or four small eminences, into four basons covered over-head, and in its chinks leaves fine yellow sublimed flowers of sulphur, especially under the basons, which  
have



have been taken up twice in my time. The water (probably that from the Bog) rises up into the empty basons, crystal clear, sparkles, bubbles in a glass; tho' it contains much muriatic salt, sulphur, and a very little calcarious earth. But this crystal-clear water, set to stand some hours in the open air, turns a pearl whitish, muddy, and loses its smell, and, as it springs up, loses all its appearance of iron or vitriol. Before the spring comes to the Day, it sends off some small branches, which meeting with ooziings of common water, weaken them before they reach their respective basons, yet all the basons are within four or five yards of one another. Tho' the water springs up thus clear, yet when any is spilt or thrown out on the pavers about the well, it turns black and thick as in the Bog, or, in the gutters in the pavers; or by standing there, it leaves a bluish, black, slimy sludge, soon covered with white rags, like thick hoar frost, or as sulphur and vitriolic, chalybeate Bilge waters mixed. These white rags in the gutters, dried slowly, and laid on red-hot iron, burn like sulphur. From Bilton, Knaresbrough, and Harrigate, to Storra, five or six miles, have outbreaks of sulphur and chalybeate waters, all from the same principles, viz. a range of the pyrites, which

breaks into dies of the colour of brown sugar-candy, and smells strong of sulphur ; and near the head of the Bog it lies within a foot or two of the surface. The late Mr. Ker of Carhead had a lease of this forest, from the late Earl of Burlington, to get coal and iron. He said, that, in digging near the Sulphur Wells, the first stratum was corn or grass mould ; the next a marley lime-stone, so abraded by acid and salts, that when dry, some of it was a mere sponge. He found also a stratum of plaister there ; the pyrites lay under the surface, above the wells. About the chalybeates was moss, then a whitish blue clay four yards thick, the gravel two yards thick, the shale twenty yards thick. Here the workmen were stopt by an impetuous subterranean current of water from the pyrites, foetid like that in the Bog ; nor did that perpetual rapid current diminish its foetor. In a field near the Bog, when it is new plowed, after a shower of rain, are found small prismatic crystals, like the Bristol and Buxton diamonds, but not so perfect and regular ; they are from the selenites. This rotten or abraded lime-stone, or (petrifications,) is in great plenty about Knareburgh dropping well, Matlock, and other petrifying waters, as the stalactites and cornu ammonis are in the caverns or grottoes



roes of lime-stone mountains. They all shew some degree of acid in the water, which unfits them for culinary uses till they have stood some time, and not from their earth, as was formerly believed; for that being fixed flies not off, but either falls down, or, being mixed with the water, turns it a pale pearl-colour, or whitish, as it has more or less, finer or coarser earth in it.

From this diversity of minerals and waters, observe, 1st, What a variety of minerals and fossils may lie heaped together in a small compass of ground. 2dly, What great and surprising works are carried on to perfection, by a natural laboratory, in the dark recesses of the earth, often without fires or furnaces, by so simple menstrua as air, water, and an acid spirit, assisted by motion, friction, and abrasion. 3dly, You see here the wonderful effects of this simple laboratory, and the inconceivable divisibility of matter thereby, into such minute particles or atoms, as no vessel or recipient, made of any matter we have, can contain or confine long. This gives us a specimen of that imaginary divisibility of matter in infinitum, talked of by philosophers. 4thly, What noble medicinal waters for health and life are here prepared, by those  
simple

simple menſtrua, not in a pompous and operoſe round-about method, but in a plain, ſimple, eaſy manner, yet to answer ſeveral different deſigns ; yea, ſometimes ſeemingly contrary, though more peculiarly adapted to ſome than others ! 5thly, See here the ſeveral ſtrange alterations that water undergoes, by being ſtrained through different ſtrata of minerals (beſides what it naturally was) ; as here the black ſulphur and vitriolic water, by being filtered through liſtſtone, is diveſted of its ſenſible vitriol, it goes in thickiſh and ink black from the vitriolic acid, fixing in ſome degree the ſulphur, and comes out cryſtal clear from the alcali, in its courſe diſſolving and ſetting at liberty the ſulphur again. This is the caſe of the warm or hot waters, the vitriolic acid in all of them ſeems partly or wholly loſt, and becomes imperceptible ; but ſuch as know how to examine mineral waters, know whether it ever was there or not, or what is become of it, and how it may be reſtored ; they know alſo why the chalybeate principle ſeems loſt in ſome, and retained by others. Such things are not diſcovered by fires and furnaces, but by ranſacking the bowels of the earth, and finding out the materials uſed in nature's operations, which will be found plain and ſimple,



ple, without force or violence. 6thly, We see the provision made to prevent the mixing of too much common water to weaken and spoil the mineral waters, by raising sufficient eminences between the Tuewhet Spaw, Cold Bath, Bog, and Sulphur Wells. 7thly, Since these eminences are low, the descent from the Bog is short and easy, till the Bog water reaches the filter; especially, tho' some of Mr. Ker's trials near the Bog were but shallow, yet he came to the best and softest water thereabout; the impregnating minerals, therefore, must lie near the surface. 8thly, Here is an evidence of the falsehood of the new opinion, that those called Sulphur Waters are such by stagnation and putrefaction; for here we have them immediately from nature's laboratory, prepared almost in our view, without any stagnation, but they keep a continual percolation.

All our Sulphur Waters here come from a strong vitriolic acid, and plenty of mineral, or native, alcali; as these two principles are stronger or weaker, so will the waters be. This holds in several sulphur waters, whether the impregnating minerals lie shallow or deep in the earth, and such as have been wrought through, seen or known, as at Wirksworth, shale and limestone; at Maudsley, tho' mixed

mixed with a current of fresh water before it reach the Day, where the workmen wrought through a thick stratum of white marle, then a very black bituminous earth full of large marcasites of sulphur, then twelve yards deep was a hard stratum of rock, through which half of the above water sprung; the other half rose through thick earth; from some hundreds of yards lower, sprung a much stronger sulphur, and salt-water, all pit-salt. This was the strongest sulphur water in England.

—The workmen's money, knives, buckles, and all white metals, turned first yellow in their pockets, and then like copper, lastly black; the steams often struck the miners blind, and confined them to bed some days. It is an imposition on our senses, to say that true sulphur waters can be from stagnation and putrefaction, where there are such large outlets always open and discharging, which must be supplied from like inlets of fresh common water and elastic air, constantly mixing with the water, causing a perpetual motion. If the inlet was less than the outlet, the common stock would soon be exhausted; if more than the outlet, the cistern, however capacious, must burst; whereof we have had instances, as some years ago happened



pened at Kettlewell, where a great rocky mountain burst, and discharged such a deluge of water as drowned the whole valley below, only from the cavern being overfilled, yet the water not foetid. Where there is a putrefaction, a stagnation both of air and water must precede. But wherever there are fit materials to impregnate a water, no occasion for stagnation. I have seen a water possessed of a strong fixed acid and phlogiston, yet void of all smell. Some sulphur waters have a mixture of marine and neutral salt; but most of the former, if strong of the sulphur. Some few Sulphur waters contain only a salt like an acaline or ammoniacal salt, not marine.

Hereby the water rising up in the Sulphur Wells, seems to be the same with that in the Bog, 1st, From its slow descent and long filtration, the smell, taste, and saltness being alike. 2. From the improbability of any other water getting into it, or out from it, being so guarded by hills, and a stone quarry on each side. 3. This filtering drain has no other visible outlet. 4. In a long drought, when the surface in the Bog is dry and crazzled over, there is a scarcity of water in the wells, as in 1740, 41, and 62.

*Of Harrigate, or other plain CHALYBEATES.*

THE Tuewhet Well rises into a small bason, is crystal clear, and sparkling, drinks pleasantly, has an agreeable irony smell and taste, is brisk and pungent, raises the spirits much, sits very light and easy on the stomach, and with suitable exercise goes soon and easily out of the body by urine. It tastes a little more rough and irony than the Sweet Spaw; its ochre is less and deeper, the water weighs some grains in a pint heavier than the former; both of them are better than St. Mungo's Well, which is never used now. The Tuewhet lies lower, nearer its impregnating minerals. The Sweet Spaw lies in a gravelly moss, covered with heath and rushes, under that shale; it rises in a moist ground, ditched about, its ochre less restraining; on standing open all night in an earthen mug, it turns blackish, and has a bluish scum. The Tuewhet water, as it rises, is several grains lighter than the other. Both these waters (like others of their class) agree very well with a milk-diet in persons accustomed to milk; but neither of them fresh taken up will lather with soap, wash linen, or  
 ans-



answer kitchen-purposes, while they retain their mineral acid. Standing, carriage, keeping, or warming, divest them of their volatile principle; which gone, they are reduced to the state of common water that has stood some time. Their fixed parts are insignificant, from one to three or four grains in a pint, two parts whereof is mofs, and the third a little neutral salt; these have no share in their healing virtues. In these waters is iron, earth, ochre, or decomposed iron, spoiled of its metalizing principle, derived chiefly from the vitriolic earth, or decomposing pyrites, which are sometimes combined with sulphur, sometimes iron or vitriol; hence vitriolic (falsely called allum) waters. Here are marcasites of iron, sulphur, glistering like gold, brass, copper, silver, vitriol, and all white metals; when the phlogiston is gone, the acid unites with the iron earth, which impregnates the waters.

1. With a little powder, or tincture, or solution of gum of galls (in nice experiments the last is the best preparation of galls, as it dissolves undequaqually, leaves no powder or earth to subside, nor adds to the bulk and weight of the sediment) it turns such water of a beautiful pink, purple, claret, pease-bloom, blue or black copper,

colour (if it turns the water blue, it contains fixed vitriol, but little iron.) Some chalybeate waters strike not instantly, till they have stood many hours, but give a charming light purple colour, rising slowly from the bottom to the surface of the water, like small threads, and colour it throughout in three or four days. Such waters have few or no volatile parts when they come to us, beside the air and water; they will bear standing open, keeping, carriage, warming, or boiling, but lie longer on the stomach and go slower off, except assisted by a bitter neutral salt and strong acid to brace well. There are also very different sorts of chalybeates; some give not the least indication of a chalybeate principle, yet are possessed of it; such come often from chert-stone, and much lime-stone mixed. If a bottle of this chalybeate water at the spring is filled, and solution of gum of galls put to it instantly, it looks well, keeps without curdling or precipitation, till exposed to the open air. Pure water seldom curdles or precipitates even with volatile spirits.

2. If a bottle of the Tuewhet Spaw is corked and carried to the inn, it tastes duller, tinges paler, with galls, than at the spring. Or if it stands corked over night, or twenty-four hours,  
it



it tinges still paler ; or if half a bottle has stood corked all night, it scarce tinges at all. If mixed with fresh Sulphur water, they do not turn black and thick, which all chalybeate waters will do with fresh strong Sulphur or Bilge Waters, till galls will no longer tinge chalybeates, for strong, foetid Bilge, Sewer, pond, or stagnant waters, all mixed with fresh, chalybeate, vitriolic, or coal Slough Waters, turn black, whilst they retain their volatile parts; but those spent chalybeates never drink so agreeably, nor sit so light, nor go so soon off the stomach, nor out of the body, nor exhilarate, nor whet the appetite, nor promote digestion so much. This tinging property is not peculiar to galls alone, for other astringents do the same, but few of them so perfectly, as green tea, oak bark and leaves, sumach, balustian flowers, red roses, &c. But the surest of all is a strong infusion of *armerius sylvestris maculatus*, spotted wild williams with their husk, fresh or dried, that gives a fainter or deeper pink or red, where is the least vitriolic acid in the water, but none, if aluminous destitute of vitriol. Galls tinging chalybeate waters, seems owing in part to the porous spongy nature of their gum, which when dissolved spreads every where in the water, entangles the

C

iron .

iron earth, fixes it in the water, and being suspended therein, by its gravity, its particles come nearer together, attract each other, becomes more ponderous till iron earth curdles and subsides.

3. As both Chalybeate and Sulphur waters rise clear and colourless, the former smells pyritical and ironie, and tastes brisk and quick; the latter has a strong sulphureous smell and taste: yet taken up, and exposed some time to the open air, or standing some hours, the former turns blackish and has a bluish scum; the latter also loses its transparency, smell, taste, and sparkling, becomes muddy, pearl coloured or whitish; it drops a small sediment, and a thin pellicle of the same, which show that both are decomposing, and that their principles are separating or altering; they cease to be of their former nature and efficacy; therefore, to have such waters good, their springs should have small basons, and the water should be drank at the spring.

The volatile parts of those waters are further evident from their decrease in bulk, as well from loss of smell, taste, and pungency, and from their ceasing to sparkle and bubble on their surface, as when fresh, like those on full proof spirit. Their alteration of parts is visible from their sudden change of colours succeed-



succeeding the use of the same substances ; as good syrup of violets is first of a rose-purple, presently blue, then a sea-green, lastly, a bright all over. These sundry variations are observable by both our inward and outward senses ; the like it is with juice of corn blue bottle-flowers, and turnsole, giving various shades ; these prove a subtile volatile acid spirit, which leaves the iron or alcali to alter the colours when the acid is gone.

— As the acid spirit goes, it strikes red, purple, &c. with galls ; its iron separates and falls down. The clear water poured off from the sediment, galls, and the above flowers, tinge it no more, have lost both spirit and iron ; but spirit or oil of vitriol put to the sediment, dissolves the iron again, and clears the water, restores the red or purple colour of the syrup and flowers.—Clean white egg-shells, set or laid twenty-four or thirty hours in the spring, turned of a yellowish ochre colour, roughish or spongy from the iron flying off, corroding and cleaving to them, hence roughness or a kind of crust from the attraction between acids and absorbents.—Steel filings put into the water attracted the iron.—The degree of acid in the water is discoverable from the weight of iron earth precipitated in the water

by galls. — How long the ironie principle continues in water after it is taken up, is known from the time it retains its tinging property with galls. — The less acid a mineral water contains, the less and shorter its conflict with the fixed vitriolic acid ; and the more it has lost of its acid, the less struggle will the strong acid have. — Small fish or insects put into this water, die immediately ; but let the acid be gone, so as galls tinge it not, they live and do well : the same it is with Sulphur waters. — They drink cool, but soon warm bodies unaccustomed to them, and seem to intoxicate a little, but it soon goes off, and leaves a drowsiness. — Evaporation or distillation signify nothing to the volatile parts, for both ways they are lost ; and the fixed are so insignificant that they contribute nothing to the benefit of the waters, therefore not worth preparing. — The waters boil well with milk, without curdling or other change, only more diluted. — They unite by a slight motion with volatile alcalis in a liquor, but not with fixed.

All those experiments shew full proof of a most subtile volatile acid spirit subsisting in the water, except that curdling of milk is not from the nitre, but from the muriatic acid to absorbent earths ; the same happens from alkaline salts in  
cer-



certain quantities. Thus we find what waters or salts curdle milk, and what acids or earth such water contain, and with such waters milk is a very proper diet.—Iron or ferruginous earth plainly appears in those waters, (for it is precipitated out of the waters, and separates from them as soon as the acid spirit is gone) 1. From the irony smell and taste of the waters at the spring. 2. From the ochre left in the basin and course, when the spirit is gone. 3. From the black colour of the habitual drinkers, their gums, tongue, throat, and fœces. 4. From their purple colour with astringents. 5. From their yellow colour with volatile and fixed alcalis. 6. From restoring their tinging property by acid spirits. 7. From the variegated scum they cast up by standing open.—That they contain an insignificant pitance of prismatic salts, appears, 1. From their hastening the decomposition of the water by standing. 2. From its deep green with syrup of violets. 3. From partly precipitating metallic solutions. 4. From distillation, evaporation, crystallization. — This earth is visible on evaporation, and is only a little black moss; but their earth and salts are so inconsiderable and common, that they deserve not to be mentioned in a medical sense, for many reputed common waters have six times more. Like



other brisk springs of common water, they contain a strong elastic air, which brought into the open air, dilates and expands itself, and carries off both volatile spirit and iron in its interstices ; hence the water shrinks a little in bulk, but proportionably increases its weight. This elastic air was formerly taken for a spirit, though common to all brisk springs that sparkle and bubble, and is of great use in all waters. The non-metallic earth in waters were mentioned before, and how to distinguish their kind. Thus we see into what small compass that great farrago of ingredients formerly said to be in these waters beyond common water is drawn, viz. a fine subtile volatile spirit, and a ferrugineous earth, and elastic air.

Now let us inquire what surprising effects these two seemingly trifling articles (attended only by the common air and water in the spring) have on diseased bodies. No part of medicine was less understood formerly, yet none has more wonderful success in many chronic, dangerous, and desperate diseases, than pure light Chalybeate Waters ; but their success has been often ascribed to non-entities in the water, or to such as had the least, if any, share in the cures ; and the want of success may be imputed to either a too late, improper, or irre-

irregular, or too short use of them. The vehicle and air have been well treated of by several, therefore shall pass them ; nor is much benefit to be expected from their fixed parts. We daily swallow some scores of grains of salt or earth, without either good or harm. The ingredients to be relied on here are the volatile spirit and ferrugineous earth. If the waters contain any oily matter that may be discovered by their turning alcohol yellow, if they have any, it merits not a place in the medical class. To form a rational judgment of the effects of those waters, having found their contents, their useful proportions are scarce determinate, but the nature and properties of each of those two ingredients should be known.

As to the acid spirit, it is invisible, incolligible, irretainable, penetrating the pores and interstices of the bowels, finds a ready way to the brain, waits not the common tedious round of digestion, circulation and secretion, makes a quick impression on the brain and nerves, such as neither water, nor the fixed parts can do. The iron dissolved by the acid spirit is divided into an exceeding inconceivable and inimitable fineness; hence it acts powerfully and speedily beyond our conception, much greater



than it could possibly do in any aggregate form it could possibly be given in ; yea, it acts far beyond the power and reach of salts ; for the solvent spirit carries the iron along with it (as is felt both from taste and smell) but wings not off the mineral salts ; hence it penetrates where salts cannot : no wonder then it is so friendly to the nerves, especially as it adds some small weight and resistability to the fluids, and elasticity to the solids. The ochrous, earthy parts contribute by absorbing, and bracing the bowels. Every one is sensible of the good effects of pure clear elastic air in common water, much more an air combined with such volatile companions as these : what opposition can stand long before such invisible irresistible agents as the acid and volatile iron ?

In some cases where waters contain a lixivial salt, they may dissolve fatty, or resolve mucous congestions or much earth ; they may prevent or lessen calcalous concretions, as in soap ; or dissolve and thin viscidities and coagulations, stimulate the fibres of the vessels, promote the expulsion or discharge of their contents. But all these fall short of the effects of fine chalybeates ; it is utterly impossible so to unite those principles as they are in their springs, for all means hitherto used to counterfeit them have proved



proved useless, or hurtful frauds. Hence it is only this elastic air, containing this active, volatile spirit that is the life and spirit of such waters; upon it depends their chief efficacy. This cheers and strengthens: this, with the iron and vehicle, recovers a lost appetite, gives good digestion, restores fluidity and certain circulation, and promotes the natural secretions. They have no equal in, invigorating relaxed fibres, and restoring their natural tone and elasticity, and promote the true exertion of their natural functions, thereby to remove obstructions; hereby good spirits and a healthy countenance are restored. The lipped and melancholic, the greatly obstructed, the wretched hypochondriac, the miserable and despairing hysteric, and even some paralytics, may hope for relief from such a penetrating, active fluid, that insinuates itself into, and through, the smallest, finest vessels in the body, and not only rectifies the state of the juices, but enables the solids to exert their right functions. Hence it is easier to conceive than number the several diseases which are rarely cured otherways, yet yield to the force of this unsearchable secret of nature lodged in the spirit of those waters. Perhaps their fixed parts may in some cases contribute some little assistance to their good effects, viz. the metal and alkaline earth  
in

in the ochre and the pittance of salt ; these may add somewhat that is deobstruent to the spirit. But most of this class have little to be depended on, beside their spirit and iron, and they are still best and most powerful in a very lax state of the bowels loaded with acids. Ferruginous and calcarious waters are good to absorb humidity, correct acidity, and brace up relaxed fibres and vessels. But if the bowels are overcharged with phlegm and flatus, sulphureo-chalybeate-saline waters are preferable. Both waters are good in a low languid state of the blood, where the vessels are neither too weak nor abraded, nor the blood too saline. They are good also in a relaxation of the solids succeeding excesses, debaucheries, luxury, idleness, effeminacy, sensual pleasures, a sedentary or studious life. In the consequence of an obstinate chronic or violent disease, no relief can be obtained equal to this. In a viscosity of the juices causing obstruction in the viscera, or of natural discharges from the womb, whether stopt, diminished, or irregular in time or quantity, painful, discoloured, or whites ; or from obstructions in the sweetbread, liver, spleen, or pores of the body and glands, which often produce jaundices, surfeits,

hypo-



hypochondriac, hysterics, melancholy, schir-  
ruses, gravel, stone, rheumatism, or perhaps  
other diseases from more remote springs, as  
lethargy, apoplexy, and other nervous disor-  
ders that embitter life ; or relaxations produc-  
ing unnatural discharges, as barrenness from  
weakness of the parts, asthma or phthisic ; or  
from relaxed solids, as a load of gross heavy  
viscid phlegm on the lungs, or glands about the  
throat, or in obstructions and defluxions with-  
out an inflammatory disposition ; for internal  
and external ulcers, used inwardly or outwardly.

Having thus given a summary account of  
some of the diseases wherein relief may be  
expected by a proper, due, regular use of those  
waters, we are to add the opinions of  
modern physicians attending the place,  
and making observations. Dr. Dean says,  
they dry too moist a brain, and help rheums,  
catarrhs and cramps. He says they are good  
against inveterate head-achs, meagrim, vertigo,  
epilepsy, convulsions, and other cold and moist  
diseases of the head. They are good in the  
black and yellow jaundice, cachexy, and begin-  
ning dropfy. They expel redundant ferosities.  
They cool the kidneys, ureters, bladder and its  
sphincter, expell sand, gravel and mucus, and  
hinder their breeding again ; they cure ulcers  
in



in those places, and in the rectum, or fistulas or other sores in the urinary passages, or perinæum, by their cleansing, flesh-breeding and strengthening virtues ; they are of great use in sharpness, difficulty, and stoppage of urine ; are of service in old gleans (not virulent) along with cold bathing, and in a too great slipperiness, moisture, and laxness of the uterus. Dr. French adds hæmorrhages, canine appetite, hydrophobia, and several sorts of fevers, chiefly intermittents, impostumes, overflowing of the bile, madness, worms, asthmas, palpitation, faintings, scurvy, piles, and bloody urine. Several extraordinary cures in hecticcs have been done by them. But they condemn their use where there are large stones in the kidneys or bladder ; but they are good for ulcers of slow cure after cutting for the stone. Women with child, or having excesses of menses, or floodings, are forbid their use. Nor are they proper for the aged ; they chill delicate women too much ; nor are they allowed to weak constitutions, or to such as have unsound viscera ; or where chalybeate medicines are improper, as in sanguine, plethoric constitutions, or such as have a quick strong pulse, or are liable to inflammations.

*Of the VITRIOLIC or ALUMINOUS WATER.*

**T**HIS water rises in the Bog in several springs nearly north of the Tuewhet Spaw, between it and the Sulphur Wells. The water rises clear, tastes very disagreeable, rough, harsh, and acerb, smells and tastes strong of vitriol, but wants the sweetish taste of alum. In that country it might very well pass for a substitute to Shadwell water in London. It curdles soap, and milk if boiled with it. With galls it is first a deep ink-black, then curdles and lets fall a black sediment, and has a deep blue transparent liquor above. A pint of it evaporated scarce leaves three or four grains of fixed vitriol, and a very little iron-earth. This clear blue water poured off from its sediment, galls tinge it no more, as it has lost its ferruginous earth. The impregnating minerals here lie a small depth, and are only a little iron and its vitriol. The impregnating mineral in this water, and the acid spirit in chalybeates, was formerly called an esurine salt, which is of a corroding nature, found either in places near the sea-side, or where great quantities of coal are burnt; or it is a preparation



paration of vinegar and copper, and a rank poison if taken inwardly. Fresh sulphur water with this, or the chalybeate waters were ink-black and thickish, they curdled and let fall a black sediment, which on standing all night becomes snow-white; the same as the spilled or thrown out fresh sulphur water leaves in the gutters of the pavers, or water course of the Sulphur Wells. If either a vitriolic or fresh Chalybeate Water is put to an intolerable foetid Bilge Water out of a ship, it is first black, then white like the other. This ink-black water with galls, if greatly diluted with rain, or common water, is a deep, clear, fine blue. This water boiled with milk gives a stiff tough curd, and a clear greenish whey. This water and lime-water turn black, opaque, curdle and let fall a large blackish sediment; but Sulphur-Water salts affect not Lime-Water, Bilge nor Chalybeate Waters. The vitriolic water, fresh, stood open, or corked, kept, or carried with gall, is ink-black, but not thickish, as with fresh Sulphur-Water; diluted it is blue, but neither breaks nor curdles soon without a precipitator, but with that it is the same as before in all respects, as to curdling, sediment, clear liquor above, with gall and fresh Sulphur-Water. If the clear water above the  
fedi-



sediment was mixed with warm fresh urine, the precipitated sulphur was dissolved, and the mixture was a golden colour. The sediment from three pints of clear vitriolic water from the galls, evaporated slowly till near dry, the remainder was first a tough blackish slime, almost void of smell and taste. When quite dry there remained fifteen grains of dry sparkling dust, gum of gall, and all which on a red hot iron over a strong fire, neither flamed, smelled, crackled, melted, nor blebbed, but left five grains of reddish brown iron earth and galls. This allum water, besides air and water, contains a little fixed vitriol, and iron earth. The iron attracts the acid of the vitriol, they unite, the latter dissolves the former, and sheathes its acid, which is absorbed and precipitated by the gall ; or the gall catches the acid and lets the iron drop. When the water has lost its iron, the acid flies to the sulphur, whose alcali both blackens the water and fixes the sulphur, in Sulphur and Bilge Waters, till urinous salts dissolve and set it at liberty again. This water drunk and used topically, externally applied, would have great and good effects in descædations of the skin, as leprosy, for drying up and healing old ulcers if used cautiously, and not too quickly, or bracing very relaxed ha-

habits, where the body is not overloaded with ferofities, or cold viscid phlegm, and the tone of the solids decayed. It is also proper where an acrid saline humour prevails in the blood; but very bad where there is an acid in the first passages, or juices, but still worse for bathing in; for it would contract and shrivel up the skin, as well as make it black, rough, hard, and wrinkled.

As I mentioned Shadwell before, and having met with nothing written upon it (only that Linden says it contains borax) I shall add what I transiently observed of it. The water brought two hundred miles to me, was of a fine deep sack colour. It seems a mere brine of green vitriol. An ale-quart of it evaporated slowly left eighteen-penny-weight of dry sediment, twenty-six grains whereof was earth, and greyish, of a strong styptic, vitriolic taste. The water with galls was a jet-black: with galls and spirit of hartshorn mixed, or the last alone, or its salt, it fermented furiously, threw a yellowish brown scum, and dropt a very small sediment two-thirds the height of the full glass; the mixture was first blackish, then black, then a deep brown, and curdled. With salt of worm-wood the water was a right cowslip-wine colour. When the water  
was



was evaporated almost dry, it was thick and tough like bird-lime, then rose up to the top of the vessel in a great thick brown froth, and under that a thin, blackish, reddish, gluey sediment, under that much grey sediment or powder; when all was wholly dry it was very spongy. The ley was a deep brown colour. The principles of this water are a green vitriol, overcharged with a fixed acid, and a little iron earth to absorb it. It is amazing to see what large quantities of this water several poor people drink every morning, even to some quarts, and with no less wonderful success, for obstinate severe pains of the stomach, worms, scald heads, leprosy, fluor albus, gonorrhœas, gleans, &c.

#### Of HARRIGATE SULPHUR WATERS.

**H**ERE were formerly only three sulphur water wells, and the lowermost the strongest, common water having got into and mixed with the mineral, till the old bason was taken up, the common water shut out, and a new bason put down, since which it has been the strongest. From under the old bason was taken off handfulls of fine yellow flowers of

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ful-

*3 leaves forward*



of the water, and had a thin black pellicle.

26. With solution of copper a reddish brown.

27. With solution of sublimate in water, carried in a close corked bottle, and standing two hours at Upper Harrigate, it was at first a little yellowish, but presently white; but tried at the well, out of the bason almost emptied, with the same sublimate, it was very yellow, of an ochre colour, then curdled and threw to the top a very yellow cream, and let fall a white powder to the bottom, a clear liquor between.

28. Sugar of lead, at Upper Harrigate, first white, then curdled, and let fall a black sediment. At the well it was jet-black, curdled, had a black circle at top, a black sediment, and a transparent sooty liquor between.

29, 30. With salts of hartshorn and natron separately, whitish, clear; at the well, a clear liquor, and white sediment.

31. Syrup of violets, at a distance, of a pale ale colour; at the well, like Lisbon wine drawn low.

32. Salt of tartar, at a distance a whitish pearl; at the well, milky, then clear, and a small woolly sediment.

33. Sal ammoniac and saltpetre altered not the water.

34. Nevil Holt salt prepared in a glass sand heat, with fresh sulphur water, was blackish, muddy, with a green sediment and scum.

35. The same salt prepared

prepared in a bright iron furnace pot, with sulphur water, was ink-black, had a deep blackish blue sediment, and light clear blue liquor between. 36. Old bottled sulphur water, and the first Holt salt prepared on a sand heat, the liquor was clear, had a small light brown sediment. 37. Two drams of fresh prepared sulphur water salt, put to half a pint of boiling new milk, neither broke nor curdled it, but set on the fire till it begun to boil it did both. 38. One dram of Holt salt presently curdled 12 1-half ounces of boiling new milk, into a stiff hard curd, and clear green whey, without putting it over the fire. 39. Four parts fresh sulphur water, did not in the least curdle or break one fifth part boiling new milk before it was set over the fire; as it began to boil it broke into hard curd and fine clear whey. The third well broke a seventh part boiling new milk. 40. Fresh sulphur water, and the vitriolic water mixed, made an opaque black liquor, which let fall a deep bluish sediment. 41. Old kept vitriolic water and fresh sulphur did the same. 42. But sulphur water that stood open all night, or had been bottled and corked three or four days, does not alter so with the vitriolic water. 43. Any of the chalybeates that have stood open



then mixed, they were a little discoloured, and scarce smelled or tasted of sulphur.—14. Strong sulphur water taken up in a dry season, barrelled in a clean cask, bunged and sealed, kept unmoved eleven days, a little of it drawn off into some fresh vitriolic water, it was muddy and darkish, but transparent.—15. At the same instant some of this barrelled sulphur water and lime water mixed, were neither curdled, altered, nor discoloured.—16. Sulphur water that was bottled, sealed, and corked at the well, carried forty miles and kept twenty-five days; when mixed with a strong fresh chalybeate water, it was muddy, blackish, but transparent, in thirty hours let fall a whitish sediment, but was darker next day. 17. The same water mixed with Coal-sough water, they were muddy, blackish, and transparent, in twenty-four hours they let drop a small blackish sediment, the liquor above was of a fine blue.—18. Sulphur water that was bottled, well corked and sealed, carried forty miles, and kept some months mixed in different glasses with coal and chalybeate waters; when both had stood twenty-hours they were quite clear, without a yellowish cast or shade. Allum affected neither old nor fresh sulphur or bilge waters.

19. Bilge



19. Bilge water and galls a dark sinoper colour, when they had stood forty-eight hours, the liquor above was yellow, and had a large black sediment. This is the most remarkable difference I have observed between Sulphur and Bilge waters, if it were so always ; but tho' I tried the experiment often, yet it answered only twice. So further, 52, 54. 20. Neither Dropping Well, nor Sulphur-Water curdled milk without boiling, tho' impregnated with different salts, the one muriatic, the other neutral, yet both curdled it at the first boiling. 21. Fresh sulphur water and salt of tartar was whitish, then a thick white cream at top, which in forty hours dropt to the bottom. 22. Sulphur water and true natron were pearl, then clear at top, and dropt a white heavy sediment. 23. Sulphur water, with salt of hartshorn, was whitish next day. 24. Several new earthen glazed brown mugs, undesignedly set all night full of fresh sulphur water in my room window, on a painted chocolate-coloured board, next morning one or two of the mug bottoms gilded the board, as though it had been done with quicksilver; the water had lost its smell and taste of sulphur. 25. Solutions of gold and silver turned the water black, and dropt a black sediment, which, on three days standing, rose to the top

fulphur. Now over a little out-break of the same water a fourth covered basin is put down. All four send out the same sort of water, but in different quantities and degrees of strength. Counting from the uppermost well (which sends out the most and strongest water, and affords most drink) the first and third are strongest, they all stand within four or five yards on the small square coarsely paved place, on the north side of a small brook.

1. These waters rise up into their basins crystal clear, pure and sparkling. 2. They all taste brackish or briny, and smell offensively foetid, yet not cadaverous, as from corruption, or putrefaction, but naturally sulphureous. 3. Take common or distilled water for the standard at a thousand, the upper well weighs 1070, the third well 1060, second and fourth 1040. This gives us the degrees of their strength or salt. 4. The spirits in the thermometer fell a third of an inch lower than in common water. 5. An ale gallon of the water evaporated slowly over a clear fire, left two ounces and a quarter of dry white sediment, a 37th part whereof was white alkaline or calcarious earth. 7. The spirits subsided the same in the third well; a gallon of it evaporated, left thirteen drams of sediment,  
twelve



twelve grains, or a 78th part was the same sort of earth. The water in the other two wells had less, though their salts and earths were of the same kind, and differed from the rest only in quantity. The second well has a little more earth in it, in proportion to its salt.

8. If the water stands open a few hours it loses its transparency, turns of a pearl or whitish colour and muddy, or, if it be bottled, corked, sealed and kept sometime, it is the same. 9. Galls, astringents, shop allum, sea or neutral salts, altered it not, only made it a little muddy. 10. Both sulphur and bilge waters turn chalybeate, vitriolic or Coalsough waters from clear to a deep sack-like, purple, crimson or ink black, as the waters have more or less sulphur in them, or are putrified, or partake more of iron or vitriol, though their several sediments are first black, but turn white above by standing, and turn a dusky brown by long standing. 11. When sulphur, vitriolic, or chalybeate waters had stood open, then mixed, after some hours they were blackish muddy but transparent. 12. But mixing them after standing twelve hours open, they were not at all black, but curdled a little. 13. If these fundry waters were bottled up fresh, corked well, and sealed for twenty-four hours,

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then

*turn back 1 leaf*



all night, put to fresh sulphur, change not, nor will fresh chalybeates turn sulphur water black that stood all night open. 44. Sulphur water salts, nor earth new or old prepared, blacken not chalybeate or vitriolic waters. 45. Powdered white arsenic put to sulphur waters three days bottled, it was whitish at first, next day it had a yellowish sediment. 46. The salt of the Sulphur well ferments strongly with oil of vitriol, but not with spirit of nitre. 47. All the three sulphur waters turn linen or woollen, or meat or greens, or legumens boiled in them, black, but did not much alter the colour of blue paper laid all night in them. 48. Lime water and vitriolic water mixed, were black and curdled, and let fall a black sediment. 49. Sulphur water and red portwine, was first a fine diluted sparkling red, then a fine purple, lastly whitish or pearl purple. 50. This water put to ale, makes a most nauseous draught, it puts an immediate stop to fermenting liquors. 51. Coalsough and lime waters alter not. 52. Bilge water and salt of tartar were an opaque, thick, greenish jelly. 53. Coalsough water and salt of tartar were muddy greenish white. 54. Bilge water and true natron, were muddy, green, opaque. 55. Coalsough water and natron were a muddy greenish

greenish colour. 56. Two ounces of fallad oil, and six drams of the bog pyrites dried and powdered fine, boiled slowly together, made a thick, rich, foetid, dark-brown balsam of sulphur, having the gross insoluble earthy part lying at bottom. 57. Some of this pyrites, grossly powdered, had ten several affusions of boiling, soft waters poured on it, and all were filtered off separately. The four or five first affusions with powdered gall were first pale, reddish, purple, then a light blue, then an opaque blue, then black; but when diluted, was blue again; it curdled but slowly, yet let fall a large black sediment, and a clear blue liquor above. Two pieces of blotting paper, one thick and a deep blue, such as is put on sugar-loaves, the other thin, coarse, and a light blue, both laid some hours in this filtered liquor, no red nor green appeared on them, but the thin, when dried, turned white, the deep blue of the other was faded. The filtered water of the ninth affusion with galls, was a clear transparent red. The gall lay undiscoloured at bottom, then came a very small curdling, the red faded much. A little small ley, and filtered liquor put to that with gall, turned instantly of a light opaque blue. 59. Two ounces of this fine powdered pyrites, which



at all, but it still remained milk and water, till it is set on the fire, then it turns to hard curd and clear whey. If more cold milk is added, then it curdles it all. Hence see, 1. That there is more or less acid in all these waters. 2. Hereby is clearly seen the proportion, degree or quantity of acid in any water. 3. To discover the acid, let the water be cold, and the milk boiling hot. 4. That there is an acid in milk itself, that joins the acid in the water. 5. That the acid in the water becomes a menstruum to sharpen and increase that of the milk beyond expectation. 72. After Harrigate water has lost its smell, examine and compare it and sea water in any manner one pleases, they will find them identically the same, their earth and salts agree. 73. A solution of sublimate in lime water, turned salt or spirit of hartshorn in warm water, a deep finoper, or raddle red colour, thick and opaque, let fall a small sediment, but both colour and sediment soon faded, and vanished in twenty-four hours. 74. Solutions of salt of tartar, natron, sal sodæ, pot-ashes, and other lixivial salts, or true nitre of the antients, by adding a little of this solution of sublimate, turned a reddish brown, or brownish red, thick, opaque, curdled, and let fall a thick red mucilage.

With



With a solution of Sutton bog salt it was a whitish pearl colour. With solution of Clifton salt, a reddish brown, which soon faded, curdled a little, turned of a light brown with a greenish or yellowish cast on the surface. Wigglesworth sediment sublimate turned from a reddish brown to a thick dirty clay colour, but fresh urine and a solution of pot ashes changed it to a whitish pink. Urine turned all these solutions in which were sublimate into whitish, like clay water; but solution of salt of tartar with sublimate, turned all the other solutions red, but all soon became thick and whitish, till urine curdled them all. From the above experiments it is apparent that this water contains both volatile and fixed parts. The fixed is evident from experiment 5, 9, 10, 11, 12, 13, 14, 15, 16, 23, 24, 25, and 43. What these volatile parts are we may learn from 3, 22, and 23. That this volatile principle soon decomposes from 26, 31, 33, 12, 13, 43, and 27. That Bilge and sulphur waters agree in some things, 8. That they differ in others, 15, 17, 20, 54, 55, and 57. There are also signs of an alcali in the water, 35, 36, 37, and 38. There is also a neutral salt in the water, 18, and 34. There is also an acid in it, 26, 27, 28,

pot-ashes, Wigglefworth, &c. smelled like spirit of hartshorn. All these solutions of sublimate, except the three first salts, were made in distilled, not lime water. Fresh sulphur water put over a fire, seems to simmer before it is warm. 66. Infusions of both burnt and unburnt lime-stone, with sugar of lead, both were white, foamed much, and let fall a white sediment. 67. Both with salts of hartshorn and tartar, vitriolic and lime waters, were very white and opaque, and let fall a very white sediment. 68. On one experiment, neither Harrigate pyrites, dried and ground to a fine powder, and mixed with nitre and salt of tartar, nor native sulphur from Sicily, made a true fulminating powder, like pulvis fulminans made with flowers of sulphur. The former two flashed in an iron ladle, like wet gunpowder in the pan when it misses fire. But on a second trial, the native sulphur made a much stronger explosion than that with flower of brimstone. Nitre and sal tartar alone fulminate not (if the ladle had no sulphur sticking to it) but heat, burn and blaze with a clear, even, white flame, till the powder is burnt to a black calx. 69. The weight of marine, rock, or common salt, coagulates the same quantity of milk, as the



the like quantity of Harrigate dried salt does ; but the chalybeates, even by boiling, coagulate it not. Carried sulphur waters, or kept, or corked, all coagulate the like quantities of milk in the like time. Sea water, Nevil Holt water, and allum water, coagulate different quantities of milk, as they contain more or less acid. 70. Lucas says, Epsom water boiled with milk, curdles not except there is more water than milk. Cheltenham curdles not milk so much as Epsom. He says, Scarborough curdles milk more powerfully than any neutral chalybeate he knows. But by adding solution of allum to them first, all three lose their tinging property with galls, by losing their volatile vitriolic acid. Pouhon boiled with milk curdles it not. 71. Nevil Holt water kept above six years bottled, corked and sealed, three pints of it cold, curdled two pints and a half of boiling new milk into a hard curd and clear whey ; but half a pint more boiling milk, made all a soft curd and a white milky whey till put over the fire to boil, then became a hard curd and a greenish clear whey ; then, after an easy boil, it curdles one, two, three, four pints more milk, and all clear. A pint of boiling milk put to three pints of Scarborough water, it curdled it not  
at



which had nine affusions of boiling water, and filtrations through fine close light blue paper, the powder dried and weighed again, had lost four scruples, half a glass of the first filtered liquor, and as much new made lime water mixed was white and thick, soon let fall a large pearl-coloured sediment, and a clear liquor above, but tasteless, and void of smell or taste of iron, vitriol or sulphur. A little soap lees put to some of the vitriolic infusion with gall, made a thick blackish blue puddle, like chalybeates with gall and sal. tart. it curdled slowly, and dropt a large sediment. 60. A little vitriolic water put to the clear above the last, made a little alteration of colour, but a little vitriolic water (i. e. the affusion on the pyrites) put to the sediment of 59, all was a dark black opaque puddle. A little gall put to clear lees, it was muddy, then curdled, full of yellow clouds, liquor reddish, then a yellow sediment, which rose from bottom to top, a deep yellow; next day it fell to the bottom again, the liquor above clear, like pale red port-wine. Vitriolic water and lime water mixed, were instantly blue, then greenish, and let fall a sediment. But vitriolic water, and infusion of unburnt lime mixed, was little altered. 61. Four ounces of fallad oil, and the

the dried pyrites left from these many affusions of boiling water, made a poor, weak, smellless balsam of sulphur. 62. Vitriolic water, with syrup of violets, was muddy, had a greenish shade. Lime water put to the last, was the same as with roses. 63. Infusion of balaustian flowers, vitriolic water and lime water mixed, both the same as with galls, a bluish purple, presently a deep blackish blue; it curdled, and let fall a large bluish black sediment, as with galls. 64. Infusions of unburnt lime-stone and red roses, and with balaustian flowers, the same as with vitriolic water and burnt lime-stone water, formed a deep blackish blue; it curdled, and let fall a sediment. 65. Sublimate made no alteration on vitriolic water; but, with vitriolic and lime-water mixed, were black, presently curdled, and dropped a yellowish light brown sediment, with a muddyish transparent liquor above. Sublimate turned the solutions of natron, tartar, pot-ashes, sutton, and all the lixivial salts, a reddish brown; so the solutions of Clifton, Wigglesworth, of hartshorn, and all the volatile alcalies in hot water, were instantly turned white and thick as milk curdled, and let fall a white sediment. But fresh warm urine put to solution of natron, tartar, Clifton, Sutton, pot-



28, 30, 48, 66. It indicates both an acid and alcali in it, 31, 47, 13, and 12. The sulphur and chalybeate waters here contain an acid, 47, 27 discovers a strong and volatile alcali. There are some ambiguous (as well as real) signs of sulphur in the water, 28, 42, 49, 50, 51. Sulphur water appears much alike, both with natural and artificial alcalies, 19, 20, 21, 29, 30, and 33. The marine acid in sulphur water salt curdles not milk before it just boils, till it join the acid of the milk 39, 41, 69, and 70. But the vitriolic acid in Nevil Holt water curdles milk much and presently, 40. Powdered pyrites is not quickly dissolved, 45. This pyrites has iron and vitriol in it, 58, 59, 60, 61, 62, 63, 64, and 65. Salt of sulphur water ferments with oil of vitriol, but not with spirit of nitre, 45. Several things alter not sulphur water.

The contents of this water, besides common element and air, are both volatile and fixed. 1. A volatile spirit evident from 27, and 73. 2. This volatile alcali meeting with the acid of marine salt, is attracted by it, united to it, and forms with it an ammoniacal salt, which is never met with in a concrete form before it is attracted and joined by some acid, especially that of marine salt. This with  
a solu-

a solution of sublimate in distilled water, is of a beautiful orange colour; with the vitriolic acid it is black; but when attracted and united to the marine acid and fixed, it is whitish and has a white sediment. It is the same volatile alkali, or rather Phlogiston destitute of an acid to constitute a true sulphur that is in Sulphur, Bilge, putrid and stagnant waters, having no acid to attract and fix it, turns them black with any acid; it is this Phlogiston also which stains bright metals; and sends out that disagreeable smell of putrefaction; but when this alkali is united, or fixed to an acid, or evaporated, these appearances cease. The union of this volatile alkali with the marine acid in this salt, is what forms a sal muriale, the natural salt of this water. This volatile alkali seems to be the chief solvent of the sulphur in this water. A solution of sublimate in lime-water, turns all the alkaline salts or sediments of an orange red sinoper, or reddish brown colour. 3. The water has also the acid of marine salt, and from exp. 47. it seems still to retain a little of the vitriolic acid. But if a yellow colour is wanted, as a proof of sulphur in the water, it is done by putting fresh urine to the water. If distillation or decoction of the water, to search for its sulphur, being instantly united to the marine acid, ceases to act



as a solvent, and cannot be brought over the helm. So that the whole principles or contents of this water, are a muriatic salt (from the union of the sal ammoniac and the marine salt) a strong alkali, a sulphur and an acid, without which there can be no sulphur. The sulphur here is evident from the water at the spring, which turns vitriolic, or fresh chalybeate water, or the black sludge on the pavers, by the acid precipitating the silver black, till the fixed alkali saturates the sulphur, which turns white again; but more fully of this in the discourse on sulphur waters. This plenty of volatile alkali makes the water more heating. Two ounces of Harrigate pyrites, one ounce of steel filings, and one ounce of oil of vitriol, put into a retort and a receiver, with four ounces of rain water luted to it, or a strong fire raised under it for three or four hours. In the receiver was found the water impregnated with a strong gas, similar to that of sulphur. And in the neck of the retort, a matter like sulphur impregnated with iron. In the retort a crocus martis, and a whitish salt of an acrid taste; here is a visible sulphur and iron. Into another retort was put Nevil Holt salt, two ounces steel filings and oil of vitriol, of each one ounce, luted on a clean receiver, with four ounces of rain water; a strong fire was given them

them for three or four hours ; there was nothing in the neck of the retort, and the water in the receiver impregnated no more than it would have been with steel filings and any neutral salt. In the retort was a crocus martis, and a white acrimonious salt, much less so than the former. No sign of real sulphur here, whatever might be of some bituminous matter. A dram of Harrigate pyrites, and half a dram of quicksilver, rubbed in a marble mortar three hours, produced a blackish-brown powder, like a sort of æthiops, gave suspicion of sulphur. A dram of Nevil Holt salt, and half a dram of quicksilver rubbed three hours together in a marble mortar, produced a powder like Dr. Burton's Mercurius Alcalizatus, which proves there is no sulphur in it. A dram of Harrigate pyrites, and half a dram of salt of tartar calcined together, produced a sulphureous suffocating fume ; the residuum was of a reddish colour, somewhat like hepa-sulphuris ; a strong proof of sulphur or sal ammoniac. A dram of Nevil Holt salt, and half a dram salt of tartar calcined together, produced nothing more than salt of tartar calcined alone, or the preparation of chalybs tart. Harrigate pyrites half a dram, white corrosive mercury ten grains, rubbed together gave no



signs of lead, antimony nor arsenic. Harrigate pyrites half a dram, white corrosive sublimate, salt of tartar, of each ten grains; instead of making it more acrimonious, as if metallic it would have done, it made it more mild. Six drams of Harrigate pyrites put into a glass, and sublimated with a strong fire, a very yellow salt of a pungent taste and suffocating gas, but in little quantity. The residue appeared like crocus martis.

*Of THORP-ARCH, or CLIFFORTH SPAW.*

**I** Cannot describe the situation of this place better than in the words of a worthy, learned divine, eminent for his probity and usefulness; a good judge, and well acquainted with the place and neighbourhood. Thorp-Arch, or Thorp-Arc, as it is in some old deeds, seems to take its name from the antient family of D'Arc, or de Arcibus, to which a large share of the ainsty of the city of York, after the conquest, belonged. This village is situated at the utmost extremity south-west of the ainsty, in the north banks of the river Wherfe, at almost an equal distance (three or four post miles) from Wetherby and Tadcaster,  
and

and thirteen miles from York, and fifteen from Pontefract. A lime-stone rock, from ten to forty foot perpendicular, faces the south road, and ford over the river. Upon this rock stands the greatest part of the village, having the church on the east, and a neat mansion-house, lately built by W—G—P. Esq; on the west, each about a quarter of a mile from Thorp-Arch; and almost the whole parish inclines to the south and south-east. A broken chain of rocks from the village extends west along by the river, near two miles, breaking out with precipices, shaded with woods, which, with the windings of the river, and the opposite banks, makes a very beautiful and romantic scene. In this enchanting place are a number of nightingales and thrushes, warbling all the summer; and where the rocks are discontinued, are natural terraces and sloping groves, all which the present owner W. G. has, with an elegance of taste and judgment which cannot but be admired, improved to the greatest advantage. But yet pleasure is not all we reap from this advantageous and improved situation. This vale and rapid river causes a constant current of air; and as all the adjacent country is champain ground, free from any morasses, fens, or putrid waters, we



are not troubled with any unwholesome damp or vapours, but enjoy a more clear and salubrious air than in most other situations. And as in summer we constantly are fanned with cooling breezes from the river; so in winter we are screened from its rudest blasts, by the rising grounds on all sides of us, at an agreeable distance. As to our soil, it is a mixture of clay and sand upon a lime-stone, which, when properly tilled, produces excellent wheat and barley; but where the clay is strong, may not be so fruitful in grass or proper for pasture as a loamy soil, or watery levels and marshes. But though we cannot boast of our hay, yet our lime-stone grounds afford as great a variety of rare and physical plants as any part of England. What strata of earth lie under the soil and lime-stone cannot be easily determined; as in our neighbourhood there are neither known or wrought mines, coal-pits, or other subterranean works of any depth (only we know from our spaw, that there must be plenty of pyrites as in our neighbourhood of the like mineral waters) from which any discoveries have been made. But that there are abundance of minerals near us, is evident not only from the spaw, but from several other mineral waters about us; as a fine chalybeate opposite to the mill, when not  
flooded

flooded by the river; a strong small sulphur spring three miles off at Collingham, &c. But whether the beds of minerals are large and extensive to any great distance, I am not able to say. I shall leave therefore these arcana of nature to better mineralogists than myself, and proceed to the account of what we have above ground. After mentioning our air and soil, it may not be improper to let you know our conveniencies of riding out whenever we chuse an airing. Scarce a mile west of Thorp-Arch, lies Clifforth moor, famous for the Earl of Northumberland's army of five thousand foot and two thousand horse rendezvousing herein 1570, to surprise and seize the north and city of York from Queen Elizabeth; but the Earl of Suffex with many other lords came upon him with a superior army, and threw the rebel troops into such a panic, that they dispersed and fled in great confusion. Two miles south is Bramham moor; those two commons so well known to the gentlemen of the turf for their even surface, fine air, and dryness, that many of their race-horses are kept in the neighbourhood, on purpose to take their exercises on these delightful grounds; and therefore, how proper, how acceptable and beneficial these commons must be for invalids to take an airing upon, is



needless to insist on. As to the water, it is most clear, sweet, and excellent (when the river is not in flood), which makes the salmon here so fine, and in London bears the greatest price of any salmon in England. But after all, if it should be asked whether in fact we find these desirable benefits from the situation? whether the inhabitants are really more healthy than in most other places? this I shall not affirm; but give me leave to mention some observations and facts which seem to confirm it. In the first place, in the sixteen years that I have been acquainted with the neighbourhood, it has had no epidemical disorders of any kind raging amongst them, small-pox, measles, and colds, excepted. 2. It has been remarked by the inhabitants, that servants hired from other places into this village, after they have been here a month or two, have had a fresher, healthier, and clearer complexion, than when they first came. These things encouraged me to look into their parish-registers, wherein I find, that in Thorp-Arch register, from 1714 to 1764, were baptised 350, buried 224, married, from 1714 to 1752, 48 couples; born in that time, 250; surprising encrease! above five births to each marriage, including dry couples, and marriages in advanced

advanced years. But taking this register in a later date, when we are sure it has been carefully kept by the incumbent (but very carelessly by his predecessor) viz. from 1751 to 1764, baptised ninety-two, buried forty-three: in Walton register, a mile distant from Thorp-Arch, from 1752 to 1763, were baptised fifty-five, buried only twenty. Three miles west of Thorp-Arch on the river side lies Collingham, wet, low, and woody on the Wherfe side, the country round about hilly, rocky, and dry. From 1721 to 1764, were baptised 370, buried 216, married 76. Here again we have near five births to each marriage. There are in the whole town forty-three families, six whereof have no connection with the lord of the manor; of the other thirty seven families, one day in 1759 he invited all his old tenants to dine with him; he was pleased with their venerable chearful appearance, as they were all of them antients: his curiosity led him to inquire into their ages, and how long they had been married, as most of them came in pairs. The ages of fourteen of them taken together, amounted to 1242, the youngest of the company being 63, the eldest 88. Five of the couples, their marriage state taken together, was 209 years.

Thus,



Thus, Sir, you see the surprising healthiness, fruitfulness, and longevity of the place seems sufficiently to prove what was intended.

I am, Sir, Your's, &c.

Now for the spaw: it was discovered in summer 1744, by John Shires, a labouring man. It rises up in the bottom of a stone-quarry, on the brink of the river, into a stone reservoir four foot and a half deep, whereby it is flooded, when the river swells high, which weakens its chalybeate, but strengthens its purgative quality, as it brings more salt along with it, it sits lighter on the stomach, and goes sooner off. It lies on the opposite side of the river to Thorp-Arch in Clifford liberty. The bottom of the well is on a level with the bed of the river, though none of its water sinks into the well except it is a flood. It is at the bottom of a sloping bank (whose perpendicular is sixteen yards) of brush wood. The spring rises out of a mountain of bastard lime-stone, and much absorbent earth. Its water rises up into the empty reservoir with a degree of force and audible noise, constantly bubbling and boiling, but into a full receiver it rises the same, without noise, because of the weight

weight of the superincumbent pillar of four foot and a half of water, equal to a column of near four inches of mercury. In the bottom of this well rise up two different springs; that toward the west is fresh, pleasant, common water, and sends out about three gallons of water in an hour; the other is the saline medical spring, which sends out thirty-six or thirty-seven gallons in an hour; both of them afford ninety gallons in an hour; so the former is to the latter near as one to twenty-nine. The former gives no appearance of salt nor steel. When the receiver is empty the water boils and bubbles up not only with a degree of force, and an audible noise, but sparkles and flies about on all sides like a thick dew or small rain. This water has not so much sensible sulphur as some others, not having volatile alkali enough to dissolve it. At the spring only there is enough of the chalybeate principle to convince us both by smell, taste, and experiments. As the water boils up continually, it runs off in a smooth even current, stains its course of a blackish brown colour, leaves a black sediment covered with a thin shining pellicle like silver leaf, a true progeny of the pyrites. When the cistern has been long uncleaned out, a great heap of thick black foetid sulphu-



sulphureous fludge lies at the bottom, such as  
 abounds in the bottom of strong, large, sul-  
 phur waters that stand long uncleansed, tho'  
 the receiver has a constant brisk discharge, and  
 perpetual supply of fresh air rising impetuously  
 through it. The water springs up pure and  
 clear as chrystal, smells somewhat sulphureous  
 and chalybeate, but not disagreeable; tastes  
 bitterish, but when it has stood some time  
 open, it turns whitish and muddy, and loses  
 its smell; a clear proof that it contains volatile  
 as well as fixed parts, and that its principles are  
 decomposing. Drought lessens the quantity  
 of salt and purging quality of the water, which  
 never freezes. It curdles not milk till they have  
 boiled a little space together. Flesh boiled in  
 it is whiter, tenderer, and eats with a finer fla-  
 vour than if boiled in common water; and  
 makes the water of a finer white broth colour.  
 For boiled in common water it is harder, not  
 so white, nor boiled in so little time; nor does  
 it give the water that whitish broth colour,  
 but continues clear. Washing the body, or  
 any part of it, in this water, whitens and  
 softens the skin much, and keeps longer clean  
 than soap. These last observations shew it  
 to be a penetrating, cleansing, softening, oily  
 water.

All the public roads about the place are turn-pikes, good and dry ; it lies near the road side from Ferrybridge to Edinburgh. The river Wherfe is pretty large here, has a good ford (when the water is low) and a boat to ferry over company to the spaw, from or to Mr. Wright's, which, at present, is the chief house of accommodation. The fineness and salubrity of this river water, is evident from its excellent salmon. August 11, 1764. Three pound twelve ounces of Harrigate water, evaporated slowly over a clear fire, left thirteen penny-weight of white salt. The like weight of Thorp-Arch Spaw, evaporated on the same fire, at the same time left nine penny-weight ; so that the salt in Harrigate water, is to that in Thorp-Arch (in a dry season, when the water has least salt) as 13 to 9. Thus we may find at any time, 1. The different quantities of salt at different seasons in any water. 2. Whether difference of weather, seasons, or nearness to, or distance from other waters, affect a spaw water. If Thorp-Arch Spaw is not often cleaned out, by standing long, the volatile acid and irony principles in the water fly off, whereby the water is greatly impoverished ; for May 19, 1764, when no water had been taken up all winter, galls at the  
spring



spring altered not the colour of the water ; but when it was thoroughly cleaned out, and the sides and bottom of the reservoir well washed, the fresh clear water as it sprung up, with gall was a deep pink, then a purple or claret colour, and so continued all summer, when often cleaned out.

Further experiments with this spaw water at the spring.

1. Infusions of fresh blue columbine flowers in common water, a charming deep blue ; with spaw water, a deep transparent bluish green.

2. Infusion of yellow stock july-flowers put to common water, a fine clear light yellow ; with spaw water, a deep brownish yellow.

3. Infusion of white july-flowers put to common water, was a fine pale yellow ; with spaw water, a very deep clear yellow.

4. Infusion of pæony flowers put to common water, a beautiful crimson ; with spaw water, a very pale pink ; next day much faded.

5. Infusion of blue hyacinth flowers in common water, muddyish and very pale ; with spaw water, green and clear at first, then clear water.

6. In-

6. Infusion of blue flowered ficklewort in common water, muddy clear; with spaw water, a fine blue.

7. Infusion of red flowered ficklewort in common water, deep greenish; in spaw water, a charming purple.

8. Infusion of spiderwort flowers in common water, blue; in spaw water, a charming clear purple; next day an opaque black.

9. Infusion of white-williams spotted flowers in common water, clear; in spaw water, reddish clear; next day, colour of beer, and a brown sediment.

10. Infusion of red roses in common water, pink; in the spaw, a charming clear red; next day, a still fine red.

11. Infusion of white roses, clear, yellowish; in spaw water, clear yellow, deeper.

12. With a decoction of logwood, opaque crimson; next day, clear yellow, black sediment.

13. With clear infusion of galls, purple; next day, pink liquor, galls, a sediment.

14. Tincture of rhubarb, reddish clear; next day, brownish red, sediment the same.

15. Syrup of violets, when stood six hours, a deep green; next day, a deeper green.

16.



16, 17, 18. Salts of natron, soda and nitre, all pearl whitish ; next day, a clear liquor and small white sediment.

19. Sal ammoniac, clear ; next day, clear and a brownish sediment.

20. Sal tartar, ooo ; next day, a clear liquor, and a large white sediment.

21. Sugar of lead, a blackish liquor ; next day, black sediment, snow white in six hours.

22. Sublimate dissolved in spring water, dropped into the spaw, dirty, muddy, clear.

23. Ditto, dissolved in } 1st and 3d, pearl,  
lime water, the same. } whitish sediment.

24. Orpiment, dissolved } 2d, pearl liquor,  
in lime water, ditto. } yellow sediment.

25. Cochineal, opaque crimson ; next day, black opaque curdled.

26. Solution of gold, clear liquor, bluish cast ; the same next day.

27. Solution of silver, clear, bluish cast ; next day, blue liquor, black sediment. Water bottled at the spaw, corked and kept twenty-four hours, then tried as the above 26, 27, were clearer, 22, milkier and thicker. The 5th, muddy, whitish. Cochineal, at spring, opaque crimson ; 14, quite yellow ; 1st, yellow, &c.

28. I took common salt, Harrigate salt, Thorp-Arch salt, Scarborough salt, Cheltenham salt, Wigglesworth, Clifton salts, Sutton Bog salt, and tried all these eight salts in a glass furnace, with sand, in several earthen crucibles, to try what glass they would produce. The first and second were quite improper for the purpose; the third afforded much the richest, finest and mellowest glass. The operator said it was the best and richest metal of any he had ever met with. The fourth would not fuse sand, vitrify, nor make any sort of glass. The fifth, though it has the most heating, pungent, acrimonious taste of all the neutral salts, yet it makes very good glass. The 6th salt mixed with sand, filled the whole glass-house with a smell of sulphur not to be endured, and flamed furiously as soon as set in the furnace; it and the sand melted quickly, and made a fine jet black glass. The seventh with sand flamed furiously, in the furnace, the salt melted quickly, and presently fused the sand and made good glass. The eighth salt has a very heating, pungent, saline taste in the furnace, it flows and flames white, yet it continues fixed, and hardens to a blackish cruzzle.

29. Common Harrigate and Thorp-Arch salts were all tried separately for soap-making.

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The first and second would make no soap, only a gritty, sandy, crumbling substance; the third still gritty and sandy, but more inclined to the nature of soap.

30. The next trial is to find, from the preceding and some following experiments, of what principles this water is composed, besides air and water. Its fixed parts, after gentle evaporation in a dry season, was, an ale gallon of the water left one ounce and six drams of very white sediment, in three ounces and six drams of which was fifty-four grains of a white alkaline earth, so that it contains above three fifths, or near three fourths of Harrogate fixed part; but not the least vestige of steel or iron to be met with in either of their fixed parts. Though after much rain, or a small flood in the river, it affords much more salt from the addition of fresh water dissolving the dry cruzzled salts in the subterranean chasms in its course. And since the spring constantly sends up so much fresh compressed air with such impetuosity along with its water, it is evident from Dr. Hales's experiment of sweetening the most foetid stagnant water, by blowing fresh air thro' it, that the sulphur in this water is not from stagnation and putrefaction, but generated from the sulphur in the pyrites.

rites. This water contains, as it springs up, as much of the chalybeate principle as either of the chalybeates at Harrigate, but, like them, it will neither keep nor carry, so that the generality of drinkers here have no occasion for a plain simple chalybeate, they having just enough of that in their water, if drank at the spring; when the receiver is low this is no small advantage to patients, who have only one water with the same ingredients of both theirs to drink.

Now since salts constitute the most material and useful of the fixed parts in most mineral waters, it is necessary that at least their more general sorts should be known, which arise from the various combinations of acid and alkali on the several soluble materials they meet with in their course or filtration, whither volatile or fixed acid arise all the differences of our sundry mineral waters. Take a few examples of their salts.

1. The vitriolic acid with a fixed vegetable alkali forms a vitriolated tartar; the same acid with a fossil alkali gives glauber salt: this acid, with a volatile alkali, affords a vitriolic ammoniac. 2. The nitrous acid with a fixed vegetable alkali sends out common nitre; with a fossil alkali cubic nitre; with a volatile alkali



nitre ammoniac. 3. The muriatic acid with a fresh vegetable alcali gives a digestive salt; with a fixed alcali common salt; with a volatile alcali, common ammoniac. 4. A vegetable acid with a fixed vegetable alcali, produces regenerated tartar; with a fossil alcali, polychrest of Rochel; with volatile alcali, vegetable alcali, or spiritus Mindereri. The four neutral salts in the last marked of each acid are called ammoniacal salts; the acids here arranged according to their attracting powers with regard to their alcalies. The vitriolic acid will decompose any of the last nine; if added to common nitre it will be decomposed and become vitriolic tartar. The nitrous acid will decompose any of the rest.

The impregnating principles of this water, so far as are vestigable, are, 1. A saline or muriatic principle (28, 29, 30). 2. A volatile alcali, which, meeting with fixed native alcali and the acid of marine salt, forms a muriatic salt (22, 23, 24). 3. Sulphur (21, 27). 4. A ferruginous earth or iron (9, 13, 14, 15, 16, 17, 18, 20, 25). Besides the common elements of water and air, it contains also a good deal of oil. Hence its salt is not a heating, acrid, caustic salt, but a bitterish, soft, gentle, smoothish salt. We are not to take to  
pieces

pieces the compound of those waters to see how they act separately, but to take each of their aggregates, as acting together; what these are we shall see hereafter.

*Of* BRAUGHTON, CRICKLE GROUND, *and*  
SKIPTON WATERS.

**A**LL these lie in a mountainous limestone country, and turn sticks, moss, leaves of trees, grass, straw, &c. reddish, or some white. The first rises up under a hedge, on the north side of an easy ascent, upon the left hand of the road from Skipton to Coln; it is just by ——— Tempest, Esquire's house, in a sweet situation, all about covered with fine woods, terraces, walks and vistas, a dry country, except in small vallies, among the hills; two or three miles of Skipton. 1. The basin and whole course of this spaw is raven black. It turns silver first like copper, then black; straw, sticks, grass, and hay, white; it turns copper presently black, yet the water is whitish. On the opposite side of the road is a chalybeate, which leaves much ochre in its course, it tastes and smells vitriolic; galls, sumach, and green tea, turns its water purple,



which prove it a chalybeate. A quart of the sulphur well evaporated in October, left a dram of sediment, a fourth of it white calcarious earth; its salt was above half marine salt, the rest neutral salt. In July following three gallons of this water evaporated, left only seven drams of sediment, a dram and a half whereof was earth. But in May 1763, it had scarce a scruple of sediment for each pint, yet all the same kind of salt. The last evaporated projected crystals: Parallelopedids, about a seventh part white calcarious earth. This water's principles are not wearing out, but common water has got into the spring, yet may be easily prevented, and the full strength of the water restored.

2. This water, with solution of gold, was first clear, then muddy, then pale green; with oil of vitriol, clear. 3. With solution of silver, muddy, and dropped the metal. 4. With sugar of lead, black, curdled, and black precipitate. 5, 6, 7, 8. With salt of tartar, of hartshorn, sal sodæ, natron, all pearl, whitish. 11. With cochineal, muddy, diluted, greenish. 12. Solution of sublimate in lime water, pearl, bluish, clear. 13. Solution of the same in spring water, blackish, transparent. 14. Tincture of gall, only muddy. 15. Tincture of rhubarb,

rhubarb, reddish brown. 16. Tincture of logwood, pale, had scarce a red shade. 17. Tincture of armerius made no alteration. 18. Powder of white vitriol, clear.

A short mile from Braughton is Crickle Spaw, it rises up within a hedge, at the bottom and west side of an ascent seven or eight yards perpendicular, about thirty yards from a morass. In rainy weather the spaw is flooded up with fresh water out of a drain in the meadow near this, which might soon be prevented. This water is crystal, clear and fine, but intolerably foetid. It turns silver and white metals instantly black. It colours its bason and course black; but all things falling into it, or lying in its way, it cloathes in snow-white robes. Quere, Have putrid waters from stagnation such plentiful outlets? or do they cloathe things in their course in such fine white dress, and black below? Below this spaw, in a small river, in the meadow, spring up many other sulphur waters, known, 1. From their deep blackness in the common water. 2. From the abundance of white matter they leave on roots, grass, straw, leaves, sticks, &c. All these springs curdle soap and boiling milk. A quart of this spaw evaporated, left four scruples of sediment, a seventh part whereof



was alkaline earth. This salt crystalized, was neutral and marine salt, each alike. All these might be made useful, as they are neither so much loaded with salt, and their salt a mixture of nitre, muriatic and common salt, and so not so heating, drying and acrid as some others; and shews they partake both of the vitriolic and marine acids; for all of them precipitate silver out of its solution, and all of them have chalybeates very near them, only their much alkaline or absorbent earth hides the former acid; and only that, not the marine, makes the nitre or neutral salt. Skipton old sulphur well curdles neither soap nor milk. This water contains much less sulphur, and has little or no marine salt in it; three pints of it boiled away, left half a dram of sediment, nine grains whereof was earth. Besides these in this neighbourhood, are many other sulphur waters, as Crickhill, Martin Church, Thornton, &c. all stronger than Braughton at present; but having not seen them, I pass them over here. At Rippon was lately discovered a plain pretty strong sulphur water, which rises out of a lime-stone hill, and transudes through a moss or turbary, and comes out in a stream of greenish yellow water, a gallon whereof evaporated, left scarce a dram and six grains of sediment,

sediment, near a half whereof was earth. The water, with solution of sublimate, was yellow, and let fall a sediment of a beautiful deep yellow, and continued so. The peat moss through which this water is strained, is full of various sorts of small, beautiful white shells, which soon burn down to lime; they are a sort of the pyrites in the hill above; it gives the sulphur to the water, not the moss, where there is no stagnation.

Now come we to a sulphur water of a very peculiar nature, such as I never met with or heard of in England besides, and deserves to be much more strictly examined and enquired into, viz. Wigglesworth Spaw, near Settle, in the parish of Long-Preston. It has been used time out of mind, and more formerly than at present, because it is little known; rains and drought affect it not. Country people drink four or five pints of it in a morning to vomit them, and six or seven pints to purge them. The water is very black, smells strong of sulphur, has a very small stream, but stagnates not, bubbles not, but springs up; it is always covered with a white scum, dies all in its course white. It rises out of a great stone soil, near much lime-stone, at the foot of a hill. It tastes salt, yet curdles not soap, and boils with  
milk.



milk. A phial glass, one third part full of it, well corked, and tied down with a bladder, and set in the cold water to be evaporated; when the water began to boil, it was taken out and poured a little of it on solution of silver, which turned black and curdled. The phial was corked again, and set half an hour longer in the boiling water, it still turned solution of silver black. It was corked a third time, and set half an hour longer in the boiling water, then tried, but was not so black as before, and caused little curdling. This last stood all night, next day its precipitation was blackish; the water was clear above. This is the only blackish sulphur water I have met with (as Rippon is a greenish yellow) and retains its sulphur the longest, from its contained oil.

Now for a few further experiments on this water.

1. With solution of gold, clear, muddy over, a pale green.
2. Oil of vitriol, a whitish pearl, no fermentation, then clear.
3. With solution of silver, muddy, yellowish, curdled, black.

4, 5, 6. With solution of copper, sugar of lead and oil of tartar, black, and precipitates.

7, 8, 9, 10. With salts of tartar, dead salt of hartshorn, of kelp, sal nitre, all pearl and clear.

11. Solution of cochineal, opaque crimson diluted, bluish pink, muddy green diluted.

12. Solution of Holt salt, dark, bluish shade, curdled, clear black opaque sediment.

13, 14, 15. Solutions of orpiment, and sublimate in lime water, yellow, clear, white sediment, bluish clear, white sediment.

16. Galls, bluish, clear, pale.

17. Tincture of rhubarb, a beautiful yellow.

18. Infusion of logwood, opaque, reddish, diluted, pale crimson, pale, scarce a shade of red.

19, 20. With allum and white vitriol, both whitish ; blue vitriol, black, curdled.

21. This water and fresh chalybeate water mixed, were muddy, blackish blue, no sediment.

22. This water, brought two miles in a wide, open, wooden vessel, and stood sixteen hours, it turned clayie, white and thickish, as foetid as at the spring. With the water out of a corked bottle next day, it was brownish with  
sugar



sugar of lead, curdled, and had a large blackish sediment.

In this country are some turbaries, or peat mosses, whose standing waters abounding with sulphur, are most foetid, so is the peat or turf dug out of them; it is of a bluish black shining colour, and so foetid when drying in the open air, that the smell is very disagreeable to passengers on the road; when dried, and brought home, some of them have whitish yellow spots, which when laid and heated on a fire, burn with a blue twinkling flame, quickly suffocating if burnt out of a furnace. This sulphur water has also some chalybeates near it. Three gallons and a half of this water evaporated, left seven drams of dry sediment, above two drams whereof was a black earth, the rest salt. This earth, which exactly resembles that in Bareges waters, seems all hairs. It is a very difficult matter to boil away this water, to obtain a dry sediment from it; and when you have got its salt dry, bottle, cork and bladder or seal it never so close, it liquifies again soon, and turns to a dark, opaque, blackish brown balsam. It ferments little and slowly with oil of vitriol, but most furiously smoaks, and bubbles outrageously with spirit of salt; it resembles the Bareges most of any water

ter we have, only that water is clear, this blackish; that has no disagreeable smell, this most foetid; that is warm, this cold. Its sediment is blackish brown. In all experiments I have tried, it differs from all other waters. Its chief principles are bitumen and a little alkaline salt.

As in the Institutes a large number of salts and sediments were tried by acids and alcalis in solutions in distilled water, so here we shall try a specimen of them dry. 1. Common salt, Harrigate sulphur water salt, Thorp-Arch salt, and sal sodæ, all fermented with oil of vitriol, but the second especially; the third fermented most furiously; few of them much with spirit of salt only; Wiggleworth violently, but very faintly with oil of vitriol; but all of them, especially the second and third, with spirit of sulphur, they swelled, bubbled, and smoked, and foamed much; spirit of nitre moved them little. 2. Separate solutions of those salts in distilled water, oil of vitriol, raised only a small conflict in the first and fourth, but caused a visible, brisk, strong ebullition in the second, and especially in the third. 3. Salts first and fourth were scarcely moved by rubbing strongly in a warm mortar and hot pestle, with crude sal ammoniac; but the second,

cond,



cond, and more especially the third, tho' they emitted not the strong volatile vapour of salt of hartshorn, yet by quick rubbing they sent out a volatile pungency smartly affecting the grinder's eyes and nose.

4. Solution of sublimate with second and third salts were very transparent, but with salt of tartar first black and thick, presently brown and opaque, then a fine liquor above, followed in a few hours by a dark sinoper coloured sediment with the fourth salt, a milky liquor, then a muddy clear pale.

5. Fifteen grains of oil of vitriol exactly saturated thirty-six grains of salt of tartar, dissolved in half an ounce of distilled water; and twenty-six grains of salt of tartar, neutralized half an ounce of lemon juice.

6. Fourteen scruples and a half of lemon juice, and twenty-three grains of oil of vitriol, neutralized sixty-eight grains of salt of tartar.

7. Eleven scruples of lemon juice, and grains thirteen of oil of vitriol, neutralized twenty-four grains of salt of tartar.

8. Scarce four scruples of spirit of hartshorn, neutralized fourteen scruples of lemon juice.

9. Twenty-four grains of oil of vitriol, neutralized four scruples of spirit of hartshorn:  
this

this was a fine, clear, reddish mixture. Both the last above it were a pale leaden colour; they fermented a little on shaking them again instantly.

10. Nevil Holt salt prepared in iron, with oil of vitriol or sulphur, fermented, bubbled, and smoaked violently.

11. A strong infusion of red roses, poured on Thorp-Arch, Harrigate, Braughton and Wigglesworth salts, all red at first, but after forty-eight hours standing, the first was somewhat paler, the second paler; the fourth, first opaque black; after forty-eight hours, a clear red liquor above, and a large black sediment. This salt, with infusion of white roses, first black, then a deep blue above, and a black sediment at bottom.

12. Infusion of spider-wort flowers, put to Thorp-Arch salt, was a charming deep purple above, and a blue sediment; with Harrigate salt, first opaque blackish, then a dark blackish muddy blue, and much sediment.

Hence observe, 1. That all natural mineral salts are not alike affected by all acids; but some salts are more affected by some acids, and others by others, as the four first salts with oil of vitriol, the strongest acid of all, but very little



little with spirit of salt, and faintly with oil of vitriol.

2. The second and third salts are more alkaline than the first.

3. That the second salt, but chiefly the third, go nearer setting at liberty the volatile part in sal ammoniac, than the first and fourth.

4. That a solution of sublimate soon shews the difference between neutral and artificial alcalis, and between volatile and fixed.

5. By 5, 6, 7, 8, 9, we see the quantities necessary to neutralize acids or alcalis, either by vegetable or mineral acids; as fifteen grains of oil of vitriol to 36 grains of salt of tartar, or little above one of tartar to ten of lemon juice.

6. From 6, 7, 8, we see whence the fermentation between acids themselves arises; whether from the stronger expelling the weaker, or from the two acids meeting and uniting with such a forcible impetus, as cause a conflict equal to a fermentation, or the weaker adds some strength to the stronger.

7. Hereby is visible how much one acid or alcali is stronger than another; or how much acid or alcali one water, salt or sediment contains more than another.

8. Though

8. Though Nevil Holt salt has a strong acid, yet it ferments violently with oil of vitriol or sulphur, it seems a vegetable, not a mineral acid.

9. The ninth shews the difference between fixed and volatile alcalis.

10. We see that tincturation discovers unsuspected differences between mineral waters or salts otherways seemingly near alike.

The signs of sulphur in a water are either more equivocal and dubious, or more certain. Of the former is that foetor like the smell of rotten eggs, or of a foul gun, &c. or changing the colour of silver, or white metals, first like brass, then like copper, lastly, if put to fresh chalybeate, vitriolic, or coalsough waters, black, curdled, and let fall a black sediment, from the volatile alcali in the sulphur, or stagnant putrid water. The next day the black sediment is snow white above, and ink-black below. But the same black water may be made clear again by filtrating it through or mixing it with plenty of absorbent or alkaline matters, which absorb the acid, and let the earth in the alcalis fall to the bottom in a white powder, and redissolve the sulphur, if it was there; and when the sulphur water is got to the

G

day



day the vitriolic volatile acid flies off, and leaves its sulphur in the waters and earth, the special marine salts mineral alcali dissolves the sulphur again. But the remainder of the sulphur turns the water and its sediment black, in whose surface the less entangled part of the remaining acid lies some time till it escape slowly, but the more entangled or fixed part is still detained in the lower black part. Thus we see a sulphur is composed of two principles, viz. acid and phlogiston; the former leaves the latter in the sludge; therefore being stript of its phlogiston loses its inflammability. The like we see in chalybeate waters, which though at first impregnated with a solution of ferruginous earth, yet being afterwards strained through much calcareous earth, the ferruginous principle becomes imperceptible, yet not lost. This acid dissolves and holds some kinds of earths firm like a salt, as allum, but with absorbent earths chiefly. When diluted with much water this affords another concrete, which while diluted, it suspends in a substance called selenites. Perhaps to the like combinations may be owing gypsum, talck, spar, &c. Chalybeates containing such earths can bear standing, carriage, and keeping better. Both sulphur and bilge  
wa-

waters are most foetid in rainy weather. Both of them kill worms, and several other insects when put into them. Either of those waters, very foetid, put into the above vitriolic or chalybeate waters before any alcalis are mixed with them, they are brown, darkish, or other shades, even, to black, according to the proportion of sulphur or volatile alcali they contain. Sulphur by its volatile acid corrodes iron. The sal medium of the other is changed into a highly volatile alcali. The steam of the one constantly diffusing itself into the atmosphere, is always unhealthy to the inhabitants near, as they often feel from the fatal effects, stirring up chronic endemic diseases around them, whilst the steams of the other makes the air very healthy, and sits much easier on the stomach (if not too salt, sulphureous, heating or drying) exhilarates more, as well as is more healthy. One is the blessings of heaven to dull, drowsy, corpulent, phlegmatic bodies, the other their bane and speedy ruin. Add to these some more certain signs, as one has the true natural smell of mineral sulphur, not so nauseous, odious and offensive; the other smells of putrefaction or half-rotten dead carcases. The spring and course of true sulphur waters are



either lined with a white slimy mucus like rags, or make hard stony bodies in their course black. After a drought before great rains, they send out their waters with greater impetuosity than at other times. They put a stop to fermentation, and make fermented liquors drink disagreeable. Sulphur springs, beside their salts, have a continual motion both of air and water, an outlet proportioned to their inlet, are constantly ventilated, so cannot putrify; the other have not, so must putrify. Sulphur waters rising up impetuously in the middle of the currents of several great rivers, and leaving their sundry dyes behind them, is another sign. Sulphur waters, tho' well brined, when bottled up closest, lose their natural smell, and contract a nauseous putrid cadaverous scent, odious to smell, taste, and stomach, and if drunk freely, would produce the like putrid symptoms, as a little of the yolk of a rotten egg. Sulphur waters by standing open lose their foetor; putrid waters by standing in the same state, increase it. Some sulphur waters are observed to have but a short constant course from their impregnating sulphureo-vitriolic pyrites, till they rise to the day. Some sulphur waters leave sublimed flowers in the crannies of the rocks through which they are strained

strained. Sometimes some of this impregnating pyrites dried, powdered, and boiled with oil, makes true balsam of sulphur, &c.

Having here given the kinds, natures, contents, and impregnating parts and principles of several saline sulphur springs, I come next to their virtues and uses, which as they agree in many things, I have thrown them together, to prevent tautologies, yet carefully observing their different intentions. The discourse proving the existence of real sulphur in those and Bath waters, is added to the Institutes, and I come now to the diseases, to which they seem more peculiarly adapted, and for the cure of which they have been observed to be most successful.

Sloth, idleness, too violent slavish exercise or labour, too great affluence, or plenty of nourishing rich high foods, spices, forced meats, acrid, stimulant and aromatic viands; the earthy viscid dregs of fermented liquors, or the parching, drying, shriveling spirits of wine, sugar, fruits, grain, or fermented liquors, as well as poverty and unwholesome diet, irregular hours, &c. are the parents of many diseases, whose cure lies in relieving oppressed nature from the unwieldy load (brought upon her by indolence, gratifying the vitiated



taste, intemperance and debaucheries) by cleansing and rousing the vessels, restoring the juices to a healthy state; rectifying and establishing the secretions and excretions of the body, and restoring vigour and activity to the fibres, vessels and solids. To the above causes of diseases, we may add pride, luxury, sensuality, inverting the natural course of time, turning day to night, and night to day. These give birth to many chronic diseases, as well as acute, from acidities, crudities, viscidities in the stomach, communicated thence to the bowels, and so to the whole habit; hence are vitiated juices, great obstructions, and a long train of diseases affecting sundry parts of the body, and therein the whole nervous system, with hypo, hysterics, melancholy, costiveness, or looseness, suppression of natural necessary discharges, &c. which require thinning, relaxing, resolving, opening, or invigorating remedies.

From these may be gathered in what disorders these waters are most likely to be serviceable, and with what limitations and restrictions, for they are a powerful and extensive remedy, yet not universal in all diseases, constitutions, sexes, ages, and from all causes.

Under

Under the name of chalybeate waters before, there is a long catalogue of diseases, wherein both they and sulphur waters are useful, and both require this general caution, 1. That before a course of either of them is begun, the common shores of the body should be cleansed from their contents and furrings, mucus and slime, and the mouths of the lacteals made accessible by the waters, and get into the blood and whole habits. 2. All plain alterative mineral waters, both sulphur and chalybeates, require to be drunk longer, and in larger quantities, than purgative waters, and the latter should be drunk in proportion to their contained salts, and the age, strength and constitution of the drinkers. 3. As most of our best mineral waters contain volatile and fixed parts, therefore they should be drunk at the spring-head, that they may have the benefit of the volatile parts, which are often the most efficacious. 4. Such weak persons as cannot, or will not drink them cold, should not warm them, but put a little hot water into them, and drink them off instantly, for being warmed any how their volatile parts are gone quickly. 5. The use of all waters should be attended with moderate (not violent) exercise of some kind, according to the patient's



strength ; and of all exercises riding is the best. 6. Such as expect the benefit they want and desire from waters, should use the proper means to attain them, by temperance in diet, both as to quantity, kind, and times of eating. 7. Nor should they sit up late at night, nor lie long in the morning, to put off their water drinking too late, and so stave off all their meals too late. 8. They must avoid all strong passions, especially the depressing, but keep up a chearful equanimity. 9. When they begin to drink, and through their daily course, gulp not down the water too hastily or greedily in a large quantity, but slowly at first, till the urinous passages are well opened, then drink ; from neglect of this caution proceed several troublesome accidents.

10. After the first passages are well opened and cleansed, I detest Dr. Russel's method of cramming down medicines along with the waters, for be the effect of the course good or bad, ye know not whether it was owing to the water or medicine ; or if the latter would do, why came ye there ? and often in his prescriptions there is no connection between the water and the medicine. Besides, how absurd is it to use purgatives along with alterative waters, where the use of the former takes away the  
benefit

benefit of the latter? Therefore they should not be used till necessity require, and then to be prescribed with judgment both of the disease, contents of the water, and patient's constitution. Ex. gr. Is the patient costive? let him chew a little rhubarb, or take a little Glauber's salt and manna, or magnesia alba, or lenitive electuary. Or if aged, gouty, corpulent and phlegmatic, take tinctura sacra, with tincture of rhubarb, snake-root, and of gum guaiac. Does his water stop, and his stomach and belly begin to swell? give Matthew's pill, soap, balsam capivi, and sal succini. Next morning give Fuller's potio alba, or a laxative. And so of other symptoms or accidents happening.

After these few necessary precautions, come we to the diseases, to which sulphur waters are more peculiarly appropriated; such are all diseases of the skin, as eruptions, scab, leprosy, tetters, ring-worms, creeping, spreading excoriations, swellings, scorbutic, arthritic, rheumatic, venereal, or their ulcers; roughness, hardness, or peeling off of the scarf skin; in these, drinking, bathing, washing and fomenting are necessary. They give great relief in relaxations of the nerves, vessels and solids, accompanied with inability and indisposition



position for motion; in gross, slow, feeble, corpulent bodies, and phlegmatic constitutions, which seem almost drowned in water, whilst the lymphatics are not broken nor distended beyond recovery of their tone. And to such as have their necessary secretions lessened by gross, viscid, or acid humours. The more saline of them are excellent in cachexies, cacochemies, beginning dropfies, jaundices, agues chiefly quartans, hard-swelled distended viscera, if used rightly. They are a great specific in all sorts of worms in the stomach or bowels, especially given nightly in glisters for the ascarides. They are of great service in want of appetite and indigestions, and for slipperyness and laxness of the uterus, and in a beginning dropfy there, or in the ovaria, and for ulcers succeeding small-pox or measles in any part, or after agues. In disorders from surfeits; in stuffings of the breast and lungs with gross tough humours; in cholics from acidities, or viscidities in the bowels. There are instances where Harrigate sulphur water has cured hæmorrhages, eructations, and vomitings of blood from the lungs, and healing ulcers there; such instances are not to be imitated; for such were obliged to the volatile acid, and iron earth in the chalybeates for their cure.

To prevent repetitions, I have here taken these waters together (as I did chalybeates) As several of them contain near the same principles in different proportions or states, therefore are not all suited to the same designs. As, ex. gr. Harrigate having much more volatile alkali, dissolves more sulphur (with which it is loaded at the spring) and muriatic salt, whose marine acid is weakened by the accession of the volatile, and fixed native alkali, to the marine acid, and forming a kind of concrete sal ammoniac. Hence so much of this composition in the water, whilst it retains its phlogiston, must be far more heating, drying, acrid and stimulating, therefore not so safe in general, as in a discharge of lymph or water, either from the breach of some lymphatic vessels insensibly oozing their contents into any of the cavities of the body, or the interstices of the muscles internally or externally, or where these vessels are distended beyond a possibility of recovering their tone. In this case, any water drunk freely, by increasing the bulk of fluids in the vessels, may cause sudden death, by an apoplexy, lethargy, &c. If in the breast, an empyema, convulsive cough, a sudden inundation there, so as the lungs have no room to play; if in the belly, they add greatly to  
the



the bulk of water there. Lean, meagre, hec-  
 tically-disposed constitutions, who have a very  
 quick, rapid pulse, acrid juices, thin, slender,  
 abraded vessels, a colliquative habit, or to cho-  
 leric people, whose fibres are exquisitely sen-  
 sible, as well as their blood sharp, or to persons  
 liable to inflammations, in any of the viscera,  
 especially in the breast or lungs, or to erosions  
 there; or to hæmorrhages, imposthumations,  
 or ulcerations in those parts, whether from the  
 acridness of the juice, or irritation of the ves-  
 sels. It may not be used in strong fevers;  
 for the water not only adds to the bulk, but  
 to the heat and sharpness, and also to the ra-  
 pid motion and circulation of the blood, heat-  
 ing, parching and drying the body, having  
 no mixture of cooling, neutral salts to allay its  
 acrimony. In sanguine constitutions, or ple-  
 thorick habits, who have plenty of good-con-  
 ditioned blood, it raises great heat, thirst,  
 head-ach and fevers; but some of those symp-  
 toms may be mitigated or prevented, by drink-  
 ing sparingly of the sulphur water, and freely  
 of the Tuewhet well, or they may be drunk  
 alternately. If the heat and thirst raise a fe-  
 verishness, cease drinking the sulphur, and  
 give an alterative small solution of nitre, or  
 of true Glauber's salt. 1. To discover this  
 salt

salt from the common bitter purging salt (which is more nauseous, disagreeable to the stomach, vomiting, gripes and sickness) dissolve a little salt of tartar in the solution; if true, the mixture is clear and transparent, but if a counterfeit from sea-salt, it is whitish and milky, lets fall a white sediment, which is its earthy matter or basis, but the basis of the other is a mineral alcali. This water may be drunk more safely and freely after thirty years of age than before. It is surprisngly adapted to gross, corpulent, heavy, dull, phlegmatic bodies, who have a low, languid circulation, slow both in body and mind; to the gouty, arthritic, leucophlegmatic, cachetic, to ale-drinkers, and such as have a sensible acid in their first passages, and a sovereign antidote against all sorts of worms in the body.

Thorp-Arch water is much safer in all the above excepted cases, as it has not so much volatile alcali salt nor sulphur in it, brings its own steel with it, and needs no other chalybeate water; does not heat, nor causes feverishness, nauseating or vomiting. Its salt is more neutral and cool; it has more fixed alcali, agrees with all ages, if rightly used. Having less salt it is less purgative, except sharpened once or twice a week with a little Glauber's



Glauber's salt. It disposes the body more to sweat, and has wonderful effects in the most obstinate rheumatic, or other old fixed pains; in all ulcers, disorders of the stomach, bowels and bladder; in a word, we have all the effects of both the sulphur and chalybeate waters. It has much oil in it, hence its salts are soft, smooth, and no ways disagreeable; it is more alkaline. Braughton and Rippon are of the same nature, and answer the purpose in proportion of their minerals; only as the salt of the first is more cooling, it is less dangerous in hectic habits. Both of them by warm baths remove descædations of the skin, take off wrinkling and hardness; are good in disorders of the stomach, worms, &c. Wigglesworth is the only bitumenous water I have seen in England, therefore if used with like judgment and care, seems to come nearest the Bareges water in France.

The best season for using mineral waters differs according to their nature; the cold waters, from the beginning of May to the middle of October; but, in cases of necessity, with proper care and caution, they may be used in winter as well as in summer, and I have often seen with as great success; for the cooler and dryer the season, some waters are the stronger.

The

The hot season is in general improper for hot waters.

From six to seven o'clock in the morning is the fittest time daily to repair to the fountain to begin to drink; sooner suits not valetudinarians and delicate persons, if later, the light, but especially the sun, dissipates the volatile parts of the waters sooner. If the waters are nauseous, or sit uneasy on the stomach, load it, or cause sickness or vomiting, take a gentle vomit; if that succeeds not, eat a light breakfast before eight o'clock, begin and drink the water half an hour after ten; I never found any of them fail to disagree after, especially if the first passages were cleansed before. If Harrigate water is drunk freely, and works not off kindly by stool, it heats, dries and inflames the body, then cooling salts given in gruel are necessary to young persons; or with infusion of senna and rhubarb, or where the stomach is weak, give them with mild bitters and aromatics. Where the patient is inclined to vomiting or looseness, ipecacuanha and torrified rhubarb are to be preferred. But bulky gross habits that indulge a free use of rich, nourishing food, and are indolent and idle, have often foul, furred, sluggish, and almost insensible bowels; they want aloetics, together  
with



with stimulants and invigorants; both do open the body. The hysteric and hypochondriac costive bellies, are best loosened (when necessary, for a habitual looseness sinks them; except by laxative chalybeates) by foetid gum pills, and extracts of black hellebore, with some salts. These, or like medicines, may be given occasionally (but not habitually) at night, or early in the morning. As to the quantity of water to be drunk, that varies much, according to the age, strength, constitution, disease, exercise and regular hours of the drinkers; for children, weak, delicate, such as cannot or will not use exercise, or that lie in bed till eight o'clock, cannot drink so much as the young and strong that rise at six, and use exercise; nor should such as drink saline springs as an alterative, drink so much as they that drink it for purging; yet there are many people Harrigate water will not work; but if they drink freely of it, it heats, dries, inflames and makes them feverish (but Thorp-Arch does not); such should either leave it off, or drink it sparingly, or drink plentifully of the Tue-whet well along with it. Children may drink from four to eight ounces twice a day. Weak persons from two to three half pint glasses in the morning. Strong people, four or five glasses.

glasses. The dull, gross, phlegmatic habits, fix or seven glasses, along with brisk exercise, from a quarter to half an hour between each two glasses, still remembering that the body be prepared as above; yet they should begin with smaller doses, and rise daily a glass or half a glass more, till they come to, and continue their largest doses; then a few days before they leave the place, lessen the dose gradually, as they increased it at first, that the natural outlets of the body may be more opened or straitened. If Thorp-Arch salt (which is not pungent and acrid) purge not by three or four glasses the first day, put two drams, or half an ounce of Glauber's salt to it next morning. They may drink more freely of it if they use exercise, the water being safer, yet effectual. Besides the above necessary preparative, tepid bathing is of special service before a course of chalybeate waters, to remove the stiffness and rigidity of the fibres, hardness of the glands, foulness and roughness of the skin, or obstructions of the pores; to soften and relax the external parts; this, and cleansing the first passages, will contribute much to the efficacy of those waters. Then cease the use of shop medicines for a time, except some accidents intervene. After the intended quantity of



water is drunk and gone off, go to breakfast, then to some exercise; let two o'clock be the latest hour of dining, here avoid intemperance in drink, and leguminous, very cold, viscid, flatulent food, or of hard digestion, as beans, peas, cabbage, cold fallads, meats dried in the smoak, cheese, eels, &c. If the water is cold on the stomach, put a very little spirits or wine in the first glass; or a little fine geneva, when the urinary passages are resty in their office. Use exercise in the morning, but get in early in the evening: sup at eight o'clock at latest, and go to bed by ten, so as you may rise by six in the morning to be ready for your water-drinking. How long the course of water is to be continued is uncertain, only in general alterative waters require a longer course than purging waters; the former often require as many months as the others do weeks. In chronic diseases, wherein a long course is necessary, their use may be sometimes intermitted for a few days or weeks. Let not the stomach be loaded at meals; shun high fauces, pickles, forced meats, &c.

*Of BATHING in MINERAL WATER.*

**I**N tepid bathing there is both an ingrefs of fome water, and egreffs of fome humours through the fkin at the fame time in the bath. The former has been long fupposed and believed, that fome of the water was abforbed by the pores of the fkin, and mixed with the fubcutaneous glandular juices ; but is now confirmed from reafon, obfervation, experiments and effects, which are often fooner than could be otherwife expected. As, 1. By the taking off or mitigation of thirft, and parching heat of burning fevers. 2. From the quick and wonderful effects of fulphur waters in diforders of the fkin. 3. The increafe of the bodies weight, even after drying, rubbing and brushing the body (which fhould never be neglected) after bathing. The fkin, in bathing in falt water, acting the part of a filter, which admits the foft fteam of the water, but excludes its falt, or fea bathing could neither allay thirft nor heat in fevers. At the fame time we are rationally and experimentally fure of the ingrefs or admiffion of water through the pores of the fkin, into the blood and glandular juices.



Though we have not the like grounds to certify the egress or expulsion of humours in the bath, yet there are very strong presumptions of it; as,

1. The person's profuse sweating in the bath from the parts not immersed; that the parts immersed being covered with the water, and so not visible.

2. From the body during its immersion, mixing and leaving in the water not only dust, dirt, dandriff, and scales washed off from the skin, but foetid and putrid matters from the small tubes of the skin, and mouths of its excretory glands.

3. From the small increase of the body's weight after bathing, in proportion to the profuse sweat from the parts not immersed, during their stay in the bath; what then must be the total discharge from all the parts immersed? But were this matter fairly tried, a little trouble would make it capable of sufficient demonstration. We may add to waters penetrating the skin, that as hurtful things applied outwardly, convey into the body something of their own quality, so must things of a healing nature convey something salutary into the body; for which reason, the wild Americans, Asiatics, Africans and savage islanders in  
all

those places, have the highest opinion of bathing, both cold and warm.

As several excellent pieces have been lately written on cold and tepid bathing in common water, and some useful hints on artificial baths; I shall not spend time on those, but leave the readers to consult the authors, and come immediately to the present subject.

1. Consider we cold bathing as acting chiefly by pressure and contraction, and tepid bathing by relaxation and dilution; I shall now take bathing in mineral waters as medicinal only, as they are impregnated with volatile principles chiefly, according to the materials they are impregnated with, whereby they are appropriated to some special uses beyond common water. Our best modern authors, as Fallopius and Baccius, say, that the first intention of warm baths, is evacuation, especially if done in sulphureous waters, by relaxing their too rigid and stiff, or bracing the lax, fibres; attenuating, thinning and preparing for expulsion, the viscid matter of perspirations in the excretory ducts or glands of the skin, and promoting free perspiration; and also by compressing the body's surface; it throws part of the humours inwardly, whereby two consider-



able evacuations are promoted, viz. urine and perspiration.

2. Relaxation, or softening the contractions, stiffness and rigidity of the parts, whether from cold, or some compacted matter, obstructions or emaciations, for which Buxton is remarkable, it being only tepid; for if the bath is too hot, it overheats our bodies, makes them sweat too profusely; often causes fainting, head-ach, weariness, sickness, anxiety; if too cool, it occasions a chilliness and shuddering, roughness and contraction of the skin, which frustrates the design of tepid bathing.

Bathing in mineral waters is much more efficacious than in common water.

1. From the mixture of saline, sulphureous, and other mineral matters with the water, whereby it is more penetrating, attenuating, cleansing, resolving, bracing, drying, healing, cooling, discussive, softening, smoothing, relaxing; as well as corrective of the viscidities, acidity, acrimony, density, or other faults of the animal juices.

2. From the minuteness of those adventitious mixtures; the medicinal parts of those waters being so small, that they are not only invisible, but unretainable by any art, and incoercible by any vessels, otherwise they had been  
been

been unfit for the ends and purposes they were designed for. Had they been otherwise, they could never have passed the lacteals, nor pierced the scarf skin, or the interstices of the fibres and vessels, and so get access into, and mix with our blood all those ways.

3. As the medicinal parts of those waters are often equal to the smallest particles of matter, as light or fire, they will not only enter, but enter in greater plenty than the water, or sooner than a steam or dry vapour, as is plain from the incolligibility and incoercibility of those fugitive parts. But the skin of a living human body is not only more thin and porous than that of other animals, because of our cloathing; but more spongy and open than glass, metallic, or earthen vessels, tho' closer than those of wood; yet the volatile and spirituous parts of mineral waters are not retainable by any of them, but make their way through the pores of them all. Or if we reflect on the aptness and disposition of those parts to enter the body, and their effects when they have entered it.

For, 1. from the smallness of their parts they enter, mix with, and are entangled both in the fibres, vessels, and their contents are diffused among, separate the adhesive, viscid,



glutinous juices in small, evanescent, capillary tubes, acting according to the nature of the volatile mineral principles, and their combinations.

2. Both from the pressure of the water, the smallness of its particles, and relaxing and softening the skin, and the penetration of the volatile parts, some, yea, not a little of the water, must necessarily be let into the body and vessels by the pores of the skin, which joining the volatile principle already let in, both will attenuate, thin and dissolve any tardy, gross or impacted matter; the vessels being loosened at the same time, the hurtful humours must gradually be lessened, and perspiration promoted by each bath. Or,

3. Reflect we on the area to be dipt, even the whole surface of the body, which in grown-up persons in general is about fifteen square feet, and every scruple of the skin has been demonstrated, to discharge a quantity equal to its own weight in twenty hours; then the perspiratory ducts must be very many in each scruple of skin; therefore the inlet of the volatile mineral vapours through the skin from the water, must be very considerable, capable of producing wonderful alterations in the body; which alterations will be more sensible,

as the waters are richly impregnated with a volatile principle, whose admission into the body, by the pores of the skin, cannot be hindered or prevented altogether by the largest discharge of perspirable matter.

1. Because the more viscid the matter shut up in the excretory ducts is, the more room there is to receive and lodge the volatile steam in.

2. Because the more viscid or fizy part of any fluid lies always nearest the sides of the containing vessel, whilst the more fluid being fitter for, and more susceptible of motion, keeps the axis of the conic or cylindric tube. Seeing then neither the force of the vessels discharging the perspirable matter, nor the pressure and weight of the body's juices, like so many columns of a far greater altitude than the bath, can prevent or stop the discharge of this matter in the bath, how should it prevent the insinuation of this volatile spirit, which not only enters by the mouths of the excretory ducts, but forces its way through the interstices themselves, and falls indrectily on the lentor or saline principle of the vessel or its sides. Nor can it be thought, that because the body is not heavier after bathing than is observed, therefore  
there



there is no such insinuation into nor mixture with the blood. For,

1. The presence of this volatile is so far from making the waters heavier in which it resides, that they are really heavier when it is gone, bulk for bulk.

2. The great increase of perspiration after bathing not only proves a relaxation, but an immision of some fluid matter than the blood, whereby it is diluted and fitted for a discharge by the skin.

3. What at once proves both the existence of this volatile principle and its insinuation into and mixture with our juices, is, that we find, by experience, any outward moderate equal warmth, relaxes the skin, opens the pores, and gives an outlet to the perspirable matter. But where the matter is gross, viscid, or cleaves close to the sides of the vessels, or sticks in the excretory ducts, it loosens and softens the skin, and dilates the vessels. The warm bath, from its salts and volatile spirit, these principles pierce their way into this gross matter, thin and prepare it for motion, circulation and expulsion, and thus ease the body without hurt or danger. But where the vessels of the skin are stuffed or stretched almost beyond recovery of their tone, relaxing alone is

not

not sufficient, the cold bath (when it may be done safely) must succeed the warm to brace up the body. Most of the diseases in which either naturally hot baths, or in strong sulphur waters, are found most efficacious and successful, and seldom fail (if early enough and properly used) are of the nervous class, because no internal medicine so capable to reach and enter these fine imperceptible delicate tubes, but such waters not only enter them when drank, but even from bathing their wonderful effects are visible.

To set this matter in a clear light: Take not only any medicinal preparation, but the fixed parts of any mineral water, when separated from it, not dissolvable in common water, dry, powder, and levigate it as fine as possible, then examine through a fine microscope, and the particles will appear larger than the blood globules and the diameter of one of the largest and first rate blood globules exceeds not one 2000th part of an inch, and the diameter of any particle visible to the naked eye, must not exceed 100th part of an inch, but Lewenhoeck and others have discovered an infinity of vessels in the body whose diameter exceed not the 10000th part of an inch. Since therefore there are vessels whose diameter are so in-

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conceivably less than the blood globules, and the most impalpably levigated substances are so much larger than blood globules, it was absolutely necessary that the more medicinal parts of mineral waters should be thus minute and fine, and that they might not only pass but even penetrate and act upon the contained fluid in those delicate tubes. There are also chronic disorders from several depravations of the nervous and lymphatic juices, and also from acrid, scorbutic, and muriatic or alkaline saline fluids, first irritating and paining the sensible delicate nervous system, or thrown out and defiling the skin, or causing inflammations, suppurations, and ulcers. Bathing in mineral waters is more powerful than in common water, because in diseases of the skin the water acts not only by cleansing, as from thinning, correcting, lessening, and drawing out the sharpness of the humors, whilst the absorbent earth dries up the oozing or weeping of the thin watery discharge from the parts, and the sulphur cleanses and heals. But it may seem wonderful that the use of those waters should answer contrary intentions, as to cure corpulency and leanness, restore contracted and relaxed limbs, provoke and stop the menses, &c. But these things are easily accounted

counted for, for the cure of corpulency depends on promoting and increasing perspiration and the other natural evacuations, exercise, temperance, and shaking off useless, yea, hurtful flumbers, and too long indulgence in bed, all tending to, and promoting a lethargic disposition.

1. The cure of leanness of the habit, or pining of any members, must be done by attenuating viscid juices, removing obstructions which prevent the secretion, or free influx of blood and spirits into the arteries and nerves, and unbending the spring of the rigid solids, and bracing the relaxed contractions indicate relaxation, to soften and render the fibres more flexible and the vessels more dilated. Palsies call for attenuating and lessening of a vitiated nervous juice, which soak and relax the nerves, hinders action and sensation, and bracing them up. Whatever adds to the motion and momentum of the blood, and determines it to the uterine vessels, may be justly called an emmenagogue, or what removes their stiffness and indilatibility, and so makes them susceptible of a greater accumulation of blood. On the contrary, whatever corrects the acrimony of the blood, lessens the quantity of the animal juices, invigorates vessels and solids, and gives



gives the blood a free course in all parts of the body, may be called an anti-emmenagogue, which mineral waters do, &c.

2. The morning or evening, in the summer time, is fittest for bathing, the stomach being then emptiest, and the body has fewest recrements; but the heat of the summer is improper for naturally hot baths, and the cold of the winter for cold bathing, except the person has been accustomed to them in that season, and have a shelter to preserve them from the injuries of the weather, and a fire to dress and undress by. In case of necessity they may, with proper caution, be used even in the winter, hot baths being warmest in the coldest seasons, and springs warmer than river water then. Before going into the bath the person should be both brushed and rubbed, to clear from the body any mucus or viscosity upon it, and to open the mouths of the excretory vessels, that the water or steam may enter them freely, and also rubbed when they come out, to squeeze out any humours or water in the mouths of the vessels, and make way for the sweat to come more easily and plentifully. The bathers stay in the bath should be according to their age, sex, strength, constitution, disease, from half an hour to an hour  
and

and a half; for it is certain, that formerly, when they stayed in much longer than now is the fashion, bathing had much better success. And that they may continue so long easily, the bath should neither be too hot nor too cold. They that bathe in the morning may stay in near twice as long as they that bathe in the evening, after a very light supper, and after a good sweat, they may be got out of bed to have it made with dry cloaths, keep warm, and sit up a little. If faint or sick in the bath, it is too warm, cool it a little, and give a glass of some small liquor. In the sweat let them drink warm white-wine, or ale, whey or negus. Bathing as well as drinking seems improper, and not suited to such as are liable to inflammations, or inflammatory fevers, and also to plethoric, hot, bilious temperaments, and to the hectically disposed, and to pining atrophic bodies; nor is it advisable during a reign of contagious, epidemic diseases, nor should they be used by such as are liable to pulmenary or other hæmorrhages. Nor should they be used before proper evacuations, nor immediately after a full meal, nor in the middle of the day in hot weather. Nor should the bath be gone into in hot weather; for besides forcing too profuse a sweat, and there-



there with unprepared matter, endangering obstructions in the skin, afterwards it may occasion sickness, head-ach, fainting, torpor, weariness, and anxiety. Nor should the bath be too cold, for that causes chillness, shivering, and straitening, or obstructing the pores of the skin: moderate exercise should be used before bathing. If after several baths the body is more alert, light, nimble, active, sleeps, digests better, the belly drawn towards the back, bathing is proper, and promises a good recovery; if otherwise, the contrary. The weak, delicate, and thin, must not continue so long in as the strong, corpulent, phlegmatic, cold, and humid, and such as have stiff rigid fibres.

The Drs. Neal, who attended Harrigate regularly every season for seventy years, and first introduced regular bathing in the sulphur waters, and made a strict observation in what complaints warm bathing and sweating after was most successful, and they found it most successful in scorbutic, arthritic, rheumatic, and in old fixed pains and aches, strains, lameness of the limbs; in stupor, numbness, or pricking pains, feebleness, cramps, convulsions; in too great laxness or weakness, rigidity or stiffness of the tendons or muscles,

stone

stone or gravel; scald heads or necks, weakness of the back, from scurvy, cold, or wet, especially; and for beginning dropfies. For paralytic pains, where the parts have not been long weakened, so as the solids are not pined, nor the spirits exhausted; in this case they assist the bath much, by adding some suitable herbs to it, or common water, and putting the decoction to sulphur water in the bath, as southern wood, marjoram, sage, angelica, lavender, bay leaves, fox glove leaves, rue, red moss from among the heath, and rub the parts well with them in the bath. They found it also give great ease in the gout, and sciatic pains in the extremes it strengthened and restored the parts. Bathers went into it moderately warm at first, and encreased the heat gradually to raise a sweat. When the bath was intended for relaxing, it was cooler, but hotter when designed for bracing. Most people staid an hour in it; but the weak could neither bear it so warm, stay so long in it, nor sweat so much. Such as had aches in the head or neck, had the warm sulphur water poured on the back part of their head and neck (this would be better done by a hand-pump set in the bath) then rubbed them well with cloths. Entering the bath too hot

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caused



caused too great heat, sweating, faintness, and feverishness, and they could not stay in so long. They avoided going in on too full a stomach. Such as bathed in the morning had a light breakfast of spoon-meat two hours before they went in. But they never went in till four hours after dinner, when they sweated in bed (as they all did) after bathing; they got them out of bed again by 8, 7, or 10 o'clock at night, gave them some light supper, and put them in a fresh bed. In many cases bathing was never neglected, as in all defœdations, or disorders of the body's surface, or in any pains, &c.

### *Of DORSTHILL SPAW.*

**O**N the very brink of the south east side of the river Team or Tame, rise up two springs at five or six yards distance, one a saline fine chalybeate, the other saline in a smaller degree; neither of them, from smell, taste, or experiments, discover any sensible sulphur, though the first is purgative. They lie five or six miles from Litchfield, and scarce two from the antient reputable borough and corporation of Tamworth, once enobled by  
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the royal seats of the Mercian and Saxon Kings, but was totally destroyed by the Danes, though splendidly rebuilt and restored by Queen Ethelfleda. After that it underwent several alterations and changes for six or seven centuries, then went to decay, was scarcely a borough, till 1561, that Queen Elizabeth, at the pressing importunity of the inhabitants, restored all their lands, jurisdictions, liberties, privileges, a weekly Saturday market, and two yearly fairs, the right of sending members to parliament, government of the town by two bailiffs, a recorder and twenty-four assistants, all under several charters, investing them with full powers.

Though these springs belong not properly to the class of sulphur waters above, yet as they resemble them in several things, and answer many of the same cases and uses both internally and externally (under the direction of a skilful physician) and are subject to the same general rules and cautions as above, allowing for different kinds and intentions, they must challenge a place here.

These springs rise up on the very brink of the Team, at the bottom of a steep bank about eight or nine yards perpendicular, where has been long observed two springs, not only



different from one another, in that one has steel and more salt, the other has no steel and less salt, but both very different from common water. These springs have been long known, but laid unregarded, except by the poor, who very often were great profitters by them, nor were there any accommodations near the place to encourage and entertain respectable company, though the air be good, the situation pleasant, healthy, dry, and an extensive beautiful prospect toward Litchfield and down the river, adorned (besides variety of common plants) with some curious and rare herbs, as millet, cyprus grass, long-rooted bastard cyprus ; black headed rush with gromwell seed ; fennel leaved water crow's-foot, tower mustard, &c. and all this in the midst of a plentiful country, both of rich meadows, corn, and pasture, though formerly all woodland, except near Tamworth, and a spacious forest.

These springs having been long observed to be eminently medicinal, the present proprietors have lately built a very neat house of accommodation, with suitable offices, gardens, and walks, and from the house to the bank forty or fifty yards level and dry walk, with stone or brick steps or stairs down to the wells and river. Both wells are walled in and tiled over,

over, and kept under lock and key to preserve them clean, and prevent any persons washing or going into them. Between the wells is a narrow clean foot-walk, and on the brink of the river is a breast-high brick wall between them. All the soil here under a rich surface, abounds with coal, iron stone, and, in some places, lime-stone, marl, and much clay, and much pyrites, though not of the dice kind, so we should have sensible sulphur, and it wants plenty of volatile and fixed alcalis to dissolve it, and produce a fixed sal ammoniac.

This water taken up out of a cleaned, emptied reservoir, is clear, sparkling, and saltish, smells and tastes of iron, which it soon loses (like other chalybeates) by standing, keeping, or carriage. The bath water is very clear; it is here used only cold, which is of great disadvantage to many patients, whose cases require it to be tepid or warm, as in weak, aged, delicate constitutions, in contractions of the joints, hard painless swellings; dropical tumors, paralytic disorders, old aches and pains, strains, weakneses, rheumatisms fixed in particular parts, fixed scorbutic pains (in all which a hand-pump is also necessary) in eruptions and defœdations of the skin, &c. In other cases look above to the external uses



of bathing in warm or cold salt or sulphur waters.

1. It precipitates silver out of its solution, which is the property of sea or muriatic salt.

2 If muddy oil of vitriol turns it crystal clear, by dissolving its earth.

3. Sugar of lead makes it a pearl colour, and lets fall a whitish sediment, thus discovers it free from real sulphur and putrefaction.

4. Salts of tartar, sal sodæ, &c. turn it first whitish, then drop their earth in a small white sediment.

5. With solution of cochineal in water, it is first pink, then purple, then a fine purple.

6. With the solution of sublimate in common water, dim pearl, clear light brown.

7. Solution ditto in lime-water, yellowish, brown clear, buff sediment.

8. This solution is yellowish, with all strong alcalis, as lime water.

9. With a gall, a fine light red, clear above a small brownish sediment. Here is very little ochre, a little iron, and a fine subtle acid spirit.

10. With tincture of rhubarb, a bright yellow.

11. With

11. With decoction of logwood, a pale reddish brown.

12. With syrup of violets, pale bluish. All last three shew an acid. Hence we see, besides the common elements of air and water, this water contains a marine or muriatic salt, a fine subtle, volatile, acid spirit, and a little earth not selenitical. Neither a half, two, nor three parts of the purging water break nor curdle one half, nor a third part boiling milk, before they are set over a fire and begin to boil; then they break and curdle. This shews the salt to be neither too heating, drying or acrid; nor chilling, cooling, nor coagulating, but a mild, gentle, neutral kind. Ten ale quarts of the water evaporated, left two ounces of dry, white sediment; two ale quarts of the bath water evaporated, left white sediment two drams. See before the uses of chalybeates.

Common, or sea salt, besides simple water, contains two kinds of salt; the one from the union of the universal acid changed by the imbibing of its earth with the native, fixed, or mineral alcali, which sea or muriatic salt have. The other salt is from this acid, now marine, united to a calcarious or absorbent earth, constituting the ley or mother of salt;



this earth always separates from the salt in evaporation ; so that this acid being always joined to an earthy base, whether a subtle calcareous earth, or the mineral alcali, it still retains its own nature and qualities. When united to a volatile alkaline base, it forms sal ammoniac, as well as a fixed mineral or vegetable alcali. From the many well-chosen, and judiciously executed experiments, that the ingenious Dr. Lucas has made on sea water, and inland springs of marine salt, they all afford the same solid and fixed contents, an earth, a muriatic salt and matter, in several proportions to the simple element ; therefore they so far correspond in their medicinal uses. He gives us both the uses, and great esteem the antients made use of sea water. Here in the Dorsethill water we have two acids, the volatile, vitriolic and the marine, as is evident from the galls, and solution of silver.

When a water is overcharged with salt for drinking, so as to cause heat, thirst, flushing of the face, redness of the skin, feverishness, urine too high-coloured, eructations, belchings and vomiting, though drunk in what may be thought a moderate quantity, it should be freely diluted with common water, or drunk warm ; so will it sit better, go easier off the  
stomach,

stomach, work more mildly and effectually, and promote the necessary discharges. But should the above symptoms happen, that dilution will succeed better if made by light, fattish broth, &c. For the future, let either less salt water be drunk, or wholly left off, and strictly observe the above general cautions; and let strength, age, sex, disease and constitution of the sick be considered. That the sea salt consists of two salts, is evident from obtaining two different salts from it, viz. common salt, and the bitter, purging salt.

To run over a catalogue of the uses of Dorsethill water, would be only a repetition of what is said of the virtues of chalybeates, and in many cases of the saline sulphur water, as they have sulphur, and this and some others steel; where the diseases in which these waters are improper, are also specified.

#### *Of SEA, and INLAND SALT SPRINGS* WATER.

**M**ANY, from ignorance, or base views, slight, neglect, or seem to contemn inland springs, impregnated with common salt and sea water, even though the former is accompanied



accompanied with the subtle, volatile, vitriolic acid, and solution of that noble medicinal principle, iron, which was treated of before, under chalybeate waters. But even sea water itself, if suitably and properly used, is by no means contemptible. The principles impregnating this are,

1. A double, or two sorts of salt, viz. common salt and bittern; one from the universal acid changed and subtilized, and united to vitrifiable earth, and the native, fixed, or mineral alkali, constituting sea or muriatic salt.

2. The same peculiar alkali, with a calcarious earth constituting the bittern, which imbibing from the air some of the universal acid, in lieu of its own, gives the neutral, bitter, purging salt, in the bitter, purging waters.

3. An absorbent, calcarious earth, which separates from the salt in evaporation, either in a thin film or scum at top, or a sediment at bottom. As to oily, unctuous, or bituminous matters (which Dr. Lucas sought and obtained from it) I have not sought for, nor observed any. It is this salt from absorbent and calcarious earth, that causes sea salt to crystallize so slowly and difficultly, and liquify again so easily, and to preserve flesh so hardly, except

cept used in a large quantity, nor to restore and make it fresh again if once tainted. This earth also turns the water soon putrid by stagnation. These, with the common elements of water and air, seem to be all the contents of this water.

From the nature of those salts being stimulating and corrugating, and from the alcalis joined to them heating, most of the healing effects of sea waters on our bodies may be easily accounted for; if to these we add the thinning, dissolving nature of water, and the elasticity of its included air. Water washes off the glaring slime and mucus, from the insides of the sluggish and relaxed coats of the stomach and bowels, and at the same time the salts are rousing up the flagged fibres of those coats, corrugates and braces them; hence the first passages are cleared, and gradually cleansed, decayed appetite and digestion restored, circulation, secretions and excretions greatly promoted, the body relieved from a lumpish, unwieldy load, spirits, strength and vigour restored, yet the body is lighter. If the vessels of the lungs are found and strong to bear much coughing, the breast will be free from a load of phlegm, breathing made easier, and life rendered more comfortable. If the habit is heavy,



heavy, corpulent, gross, and almost deluged in phlegm (and the lymphatics not yet broke, nor discharging into any internal cavities) it will promote its expulsion by natural outlets. If the head or brain are overloaded with water, weakening the memory and intellectual faculties, threatening palsy, lethargy, or the like disorders. If the body is cachetic, or has cold, slow, glandular swelling, or external ulcers. In a cold, moist, sluggish asthma, &c. Some disorders of the urinary passages, as in stranguries, in early youth and old age, from a kind of insensibility or relaxation of the muscles, or coats of the bladder about its neck.—In all these cases great benefit may be reaped by the proper and judicious use of sea water internally and externally. The gentle stimulation of the acid and salts, braces up the fibres to a due discharge of their office. This acid, joined to a volatile, alkaline base, makes a sal ammoniac; or charged with a fixed mineral or vegetable acid, it is a slow antiseptic. With these it resolves powerfully, opens obstructions, cleanses, discusses and provokes urine. With absorbents or calcarious earth, it resolves viscidities, stirs up sluggish fibres. Salt is a great drier and heater of the body. The habit of body and constitution of the sick

sick should be well attended to; for the dry, hot and bilious have nothing but hurt to expect from sea water, such whose tongues are dry and clammy, and have a salt or bitter taste in their mouth, or have hot sharp urine, and often called to make it; or have a hot sharp rheum about their mouth and throat, attended with much coughing; or very sanguine and plethoric, and are liable to inflammations or ulcers; or where the pulse is too quick, circulation rapid, with a hectic disposition, frequent flushings of the cheeks, too great briskness or brilliancy of the eyes, a delicate complexion, a squeaking voice, or liable to quin-sies, pleurifies, hawking, spitting or vomiting of blood; a dry, crisp skin, incessant itching, great heat, eruptions of red, angry, fiery pimples, habitual costiveness of the lower belly; all these absolutely forbid the use of sea water. Thus we see its use is chiefly adapted for phlegmatic constitutions, which have redundant moisture, that makes them dull, lazy and sluggish; or where there is a relaxation of the solids. Hence it is better suited to the decline, than spring or rise of life.

All sea waters, not being of an equal strength, will purge in proportion to the salt they contain; as they have not an equal quantity of salt, they



they cannot purge alike ; for water taken up near the shore, or mouths of rivers, being mixed with much fresh water, is not so salt as that taken up in the ocean. The hotter the country is, the saltier the sea water : for that near the equator is stronger than that on the British coasts ; and that stronger than in the northern about Lapland, &c. For the colder the climate is, the less salt is the sea water ; therefore the sooner and more it freezes, till it form whole mountains of ice : the less salt the sea water is, the more numerous its aquatic inhabitants, as in the northern seas, Siberian, Newfoundland, &c. On the contrary, the more salt the sea water is, the fewer its inhabitants, till it become brine and almost barren. The more bitter, sea or inland spring waters contain, the more purgative they are ; hence Cheshire-wych waters or salt, purge better than Worcestershire brines or salt ; for the more absorbent, calcarious or alkaline, either they or sea water contain, the more bitter they have. The hotter and dryer the season is, the hotter and dryer are the drinkers of those waters. The cooler and moister the season is, the milder it works, and heats and dries less ; therefore the same quantity of sea or pit waters is not to be drunk at all places, nor at all seasons,

seasons, far less by all constitutions, ages, and in all diseases. Sea or other salt water having marine salts diluted with spring water to a certain degree and drunk, makes it sit better on the stomach, and work more mildly. Thus Harrigate water that contains about a fifty-seventh part salt, and Thorp-Arch, which contains about an eightieth part salt, the latter works more pleasantly, heats and dries less, and suits many cases and constitutions better. Wherever the basin or receiver is deep and large, the water should be raised by a hand-pump, or a corked empty bottle let down. Though the water at bottom is saltier, yet by stagnating often, it loses much of its volatile parts. I have known some excellent chalybeate springs, whose water, by long stagnation in their large, deep reservoirs, have lost their volatile acid, dropt their earths, turned black with galls, let fall a large irony sediment, had a clear, blue, vitriolic liquor at top; the like loss I have observed in sulphur waters. So sensible a damage is done to the best mineral waters, standing long in too large and deep basins. The use of these, and all purging waters, should be ushered in by cleansing the first passages, and beginning with lesser doses, and increasing them as occasion requires; if they



they heat, bind, or dry up the body much, or gripe the bowels, they should be diluted with spring water, or fat light broths. Let us next take a view of the bitter purging waters, whether plain or chalybeate.

### *Of BITTER PURGING WATERS.*

**F**ERMENTATION with mineral acids, in bitter purging waters, is from two causes. 1. From the fixed acid expelling the volatile acid. 2. From the alkaline absorbent, or calcarious earth, which hides the steel in many of them before they reach the day, as I have observed to be the case in deep reservoirs, which shews the necessity of a small neat hand-pump, to raise either chalybeate or sulphur waters, from the bottom of the well, or during the season, it should every morning be emptied and cleaned out to the bottom. For in a deep cistern, the first six or eight inches under the surface has lost much of its volatile principle. Nor will dropping in a few drops of mineral acids supply the loss, as the natural is volatile, and this fixed, or neutralized by the earth in the water, and the remaining volatile expelled by the fixed. Here we see  
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the great error of warming mineral waters, having a volatile principle, before they are drunk. And the delicate, who cannot drink them cold, should warm them at the spring-head with a little hot common water. Hereby may also be seen the great loss such waters sustain by being kept bottled all night in the house, or carried a mile or two before they are drunk. This is also evident in the Bath (and other naturally hot waters) which drunk hot at the pump do sensible injury to hectic and consumptive persons. But the same water exposed all night to the air may be safely drunk next day, when it has lost its volatile parts, not its steel; for the Tuewhet well, Astrope, &c. drunk at the spring, have cured great numbers of those diseases, when regularly used for a due time. The mischief done in those diseases, by Bath or hot waters, is not from their scantling of salt, since a quart of the water at most affords not above 36 grains of sediment, thirteen or fourteen whereof are selenitical and absorbent earth, twelve grains sea-salt, and seven grains neutral salt. And who eats and drinks not daily double that quantity of salt and earth in his food? Then there remains (beside water and air) only sulphur. And if there is only supposed sulphur in the water, the



effect of stagnation, then why are not the inhabitants of low, flat, marshy countries, where the waters in dry hot weather putrify, most liable to inflammatory diseases, as hectic, pleurifies, peripneumonies, consumptions, &c.? Or why do we send our hectic and consumptive to Holland, and low countries? Observation shews that such amphibious creatures are liable to other kind of diseases, as agues, dropfies, cachexies, &c. and from a lax fibre, diminished perspiration, weak, watery, fizy blood, have often phlegmatic habits, &c.

Again, where and how long do Bath waters stagnate to generate putrification and foetor? Do not the baths constantly run over? Are they not often let off and cleaned? and has not the succeeding fresh water, let into the baths, the same smell, taste, nay stronger, though continually let run to waste, having an incessant supply and circulation?

Of the bitter purging salt waters, some are sulphureous, some chalybeate. The latter are cooler than with sea or muriatic salt. The former, bringing much alcali as well as marine salt along with them, are more heating and drying; and though they bring steel along with them, yet their alcali makes it imperceptible both to  
our

our senses and experiments ; for it is the vitriolic acid that neutralizes the salt, which is accompanied with a selenitical earth; or with that and common or insoluble earth it will retain its steel more visibly, though seemingly less.

In plain bitter purging waters, the vitriolic acid, neutralized by the alkaline base of the fossil salt and some absorbent calcarious earth, form the salt. Such waters may be used as alteratives (if they have salt enough) and are of special service in all viscidities or acidity in the stomach and bowels ; and, if attended with steel, they act more powerfully in removing obstinate obstructions, surfeits, and scurvy in cold phlegmatic constitutions. Though such waters do purge moderately, yet they strengthen the body, whet the appetite, promote good digestion, and raise the spirits. Such waters, both plain or having sulphur or steel, are of extensive benefit to a variety of sick and diseased, as Scarborough, Cheltenham, Malton, &c. In August 1752, I received two dozen of Alkerton (it lies on the high road between Gloucester and Petty France in the way to Bath) water. Thirty seven pounds thereof were evaporated on a sand heat. They left eighty two penny weight and a half, or four ounces and a drachm, of very white, clean,



clear salt, and seven penny-weight of a light pearl-coloured earth. As I went that way on November 20, 1752, I stopt to see the water, which taken out of an open draw well, ten yards deep in a farmer's house yard, had no sensible signs of steel or sulphur in it. It tinged not with galls, oak leaves, or green tea, but instantly precipitated silver out of its solution. A pint of it, boiled slowly away, left ninety-four grains of snow white sediment, eight grains whereof were earth. The salt crystalized with great difficulty, seemed to be the same as Cheltenham, only had a little marine salt along with its neutral, and its earth mostly felenitical. What the water contains or would be, was it taken proper care of, could not be judged of from the open ruinous state it was then in; only it appeared to be a very good purging water.

Next day I made a short halt at Tewksbury, and found several out-breaks of saline springs inclosed in pasture-ground; especially three, one in the town-ground a mile off; another near by it, within a hedge, in Walton grounds; and a third a mile further off, in Teddington grounds. This is the strongest. All three lie on a line on the same level, and all have pumps for cattles drink. The first two were out  
of

of order. A pint of the third, boiled away slowly, left eight scruples of snow-white sediment, five scruples of which were a white alkaline earth, as was that of Alkerton. Both salts were like Cheltenham, very hot and pungent, precipitated silver, and gave no signs of steel or sulphur in that condition ; were the same, and crystalized slowly. Teddington salt soon fell down in a white mealy dust. There are many such springs in this country.

### *Of the* DROPPING WELL.

**F**ROM purging waters it is proper to turn to another sort, viz. petrifying, and of that class to take a pretty noted one, viz. Knareborough Dropping Well, though its petrifications are not so beautiful as many others. As this is not used, it might be omitted here ; but, as it is a mineral water, it belongs to this place, and might, if properly drank, be of special service in several cases. Therefore I take notice of it. It rises up about twelve or fourteen yards below the summit of an easy ascent of hard marle, or more properly coarse lime-stone, with a mixture of clay, on the west side of the town and river,



a little from the bank of the Nid. After some short cascades, it falls down the ascent, and is divided on an isthmus of a petrified rock generated out of this water, and spreads round it. This isthmus, to the front, is ten yards high, to the backward twelve, sixteen long and fourteen broad. It slipped down from the common bank above sixty years ago. In the chasm between the isthmus and bank, and round about, are all manner of petrifications, some of them very beautiful, interwoven, and forming charming figures and stalactites, very hard. This is a plentiful spring of very sweet water, clear as crystal, and of equal weight both at the spring and rock. A pint of it, evaporated, leaves about twenty grains of sediment, fifteen grains earth, mostly absorbent, with a little selenites, and five grains salt, all neutral. The water, with tincture of rhubarb, is yellow; of logwood, red; of galls, &c. no changes; with sugar of lead, very white and thick, and has a large white sediment; with oil of tartar, white, letting fall a white precipitate. The fixed parts are as white as the finest chalk. The water neither whitens solution of silver, nor gives any precipitate. Seven scruples of the salt crystalized proved only sal muriale. None of the petrifications are  
made

made in summer, all of them in winter, and the colder it is the greater number and larger. This water filters through a thick stratum of shale, under a thin bed of marly limestone and clay. These petrifications are very brittle. In vinegar they send out many air-bubbles, but in mineral acids fall down into a white solution, with violent fermentation, smoke and fume. The vicinity of shale, the milkiness and white precipitate in them, and the ready solution of the petrifications, all prove them the produce of an acid solvent, which both dissolves the earths and generates the salts. Such being the composition of this water, we thence see to what disorders they may be chiefly appropriated; for as these waters promote coagulation of milk and soap, their earths seem to be of a rough astringent nature. But since warmth and motion prevent petrification, there is little ground to fear those effects from them in living bodies, though it may be unadvisable to indulge with too large, unnecessary quantities of them, since here is an absorbent restraining earth, existing in such small particles. Here seems to be an excellent remedy for hæmorrhages or fluxes from any part of the body, colliquations or solutions of the animal juices, either from an acrid or muriatic



salt, dissolving the due and healthy texture of the blood and juices, or when the sharpness of the blood and lymph have abraded and weakened the inside of the blood-vessels; or where the vessels are tender, weak and thin, or the secretory ducts and strainers are widened, and pour off the fluids too quickly; or where the animal secretions are morbidly increased in unhealthy discharges of blood, urine, sweat, stool, phlegm, or fluor albus; in ulcers of the viscera, hectic, atrophy, or in cases where thickening, healing, strengthening, cooling and cleansing are indicated. In these cases they should be used with discretion and preparation; a quart or three pints is pretty well for a morning dose; only moderate, not violent, exercise is to be used with them. The water must not be needlessly hurried out of the body by diuretics and purgatives; nor should the drinkers use ale, drams or punch along with them. A strict regard must be had to diet along with them, as milk, eggs, jellies, barley, almonds, rice, panado, chickens and chicken broth, veal, lamb, quince and its marmalade, roasted apples, pears, &c. with the like nourishing, restraining, cooling food, red port and the water. Avoid heating, sharp, salt, stimulating things, as onions, pepper,

pepper, ginger, radishes, both in diet and by themselves. But these waters must not be used where there is a thickness of blood, diminution of perspiration, secretions or obstructions, as in jaundice, dropsy, stuffings of the vessels of the lungs, suppressed menses or piles, costiveness, stoppage of the lacteals and mesentery, lymphatics or glandular swellings, schirrhus, hardness of the spleen, or wherever thinning, relaxing, opening, cleansing, attenuating, inciding and stimulating, are wanted.

### *Of NEVILL-HOLT SPAW.*

**T**HIS, so far as we know, is the only spaw in England of its kind; but its distinguishing principle was never truly discovered before the month of January 1761. Its success has been very surprising from the time of its discovery, in the year 1728, in proper cases, and when regularly used. And as it has been maliciously represented as an aluminous water by the ignorant, prejudiced, or mercenary, it requires to be more thoroughly, strictly, and carefully searched into, than most mineral waters in England, and far more experiments to be bestowed



bestowed on it. A tythe of the latter the reader shall not be troubled with here ; only so many as are necessary to silence unjust clamours, vindicate the truth, and be of use to the sick.

This water lies in the county of Leicester, bordering on Northamptonshire and Rutlandshire, on the north-east side of the road from Market-Harborough to Uppingham, seven miles from the former, and five from the latter ; half a mile from Holt, the noble seat of the ancient family of the Nevills. George Nevill, Esq; is the present proprietor and possessor. His house is situated on the summit of the highest hill in Leicestershire, commands an extensive prospect, in a most healthy air, and is surrounded by a landed estate of a rich soil.

This spaw was accidentally discovered in 1728, by the lady then proprietress, who let the field to a tenant. He, wanting water for his cattle in those dry grounds, searched for and observed, on the descent of the hill, a little moisture on the surface of one place. There the lady caused a small pond to be made, where, in a week's time, a little water gathered ; but the cattle, on tasting, would not drink it, being salt, bitter, and very acid. This taste was at first judged to arise from an old broad spread oak  
that

that shaded and dropped into it. The tree was cut down and stubbed up, but the water still kept its taste. The soft surface of this moist place being removed by digging the pond and paring the earth about it, there was found a reddish stiff hard clay, with large lumps like honeycombs, yellow, and full of holes. When broken they were lined with an hard iron-like rust : the sludge in the bottom of the small pond had nothing ochereous in it, but was black and shining, though kept clean. In this manner it lay some time, and the water, being tried upon brutes both inwardly and outwardly, quickly cured many dogs, galled horses, fresh wounds, hæmorrhages both by stool and urine, putrid looseness, or other putrid diseases ; blotches or blains on the skin, &c. &c.

The water was then sent to London to be examined by the late Dr. Strother and another physician, and they called it a nitro-calcarious chalybeate. Of the same opinion was the late Dr. Farrer, of Market-Harborough. They, with great reason from its wonderful success, recommended the regular use of it to many of their patients. Its success continuing, the whole neighbourhood flocked in to drink and carry away the water on Sundays and



and holidays, so that the tenant's grafs and herbage was trodden down and spoiled. All this ground was formerly covered with a great wood.

The uncommon taste of the water made some think it might be produced by some minerals or metals, in search of which men were employed to dig up the hill from the middle of its descent, where this moist place was, to its top, seventy or eighty yards. They found neither spring nor current of any water in all that space, but only a small exudation of moisture issuing out of a thin stratum of black earth, (not above an inch or two thick) like a dew on a hard-labourer's face before he sweats. This dew gathers into drops, which trickle down all the above length, upon a row of thin shelving free-stone into a small stone gutter, and that into a stone spout, which conveys it into a clean forty gallon fine stone receiver, which contains more than it commonly drops in twenty-four hours. In that time it seldom drops above thirty-six gallons (a quantity sufficient for two hundred drinkers) except in long heavy rains or sudden great land-floods. Then it turns sometimes red or purple with galls, and even when it runs sixty, seventy,

seventy, eighty or ninety gallons, it leaves little less salts and earth ; but its peculiar principle of acid is greatly weakened. The least it ever dropped was in the great summer drought of 1742, when it scarce dropped seven gallons in twenty-four hours; yet its salts and earth were no greater, but its acid was so strong that it was not drinkable before dilution. When flooded, the flood is over in seven or eight hours, and the water good again. The small diminution of the salts in a rainy season arises from the water washing down the salts in the before dry crannies and passages of the earth, whereby they and the water are both increased ; but the same acids being diluted in double the quantity of water, must be weakened.

The above stone cistern is set under the spout with a strong stone arch, and a stout oak-door and lock on it. Here they may gather and bottle water either from the spout or cistern, equally good. The aforesaid black thin stratum of earth runs horizontally under the rising hill the whole length. The diggers dug a good way below this stratum, but not the least sign of the water or other minerals beyond it.

In 1757 was observed another smaller or weaker exudation of a strong vitriolic chalybeate



beate water ten yards N. E. of the spaw, but different from it, very disagreeable to both taste and stomach. This is shut up, and never used. But had it been wanted, dug up and investigated to its origin, it might perhaps have been found a very different water to what it was in that long, stagnant, muddy, claiey state. It had much ochre on its sides and bottom, and several experiments were made on it. It had a strong taste of iron and fixed acid. All behind the arch and along the side of the stone gutter was rammed with stiff strong clay, to prevent common water getting in.

The diggers, in their pursuit of this exudation, found heaps of talc, felenites, marcasites of iron, and capillaceous sprigs, not unlike some of the caroline tribe, besides the above honeycomb balls; and another sort of earth of a bluish colour, resembling a very pale alum stone, but when dried was of a very different nature, being like fullers earth, answering the same purposes, but destitute of taste. The clay itself is a fine English bole, which though hard and stiff when raised, yet, when exposed to the heat, turns greasy and soft like butter, shewing it to have a mixture of bitumen. In this hill is much iron-stone,  
coarse

coarse free-stone, and bastard lime-stone. The iron-stone seems to lie hollow in the earth. Under the surface lies a confused heap of minerals. A mile from this is a petrifying water from a calcarious earth. The hardest frost affects not the water under the arch. The greatest variety in the temperature of this water, as it drops, is from fifty-two in the hardest frost, to fifty-six in the hottest time. When the water has stood unlet-off all winter in the stone-cistern, it lets fall a clear thick jelly-like shot star, horridly foetid. This is sometimes the case with the water when put up in wet bottles, or slightly corked and sealed, but it is restored by decanting it into a bason until it becomes sweet again.

As the spaw water drops it is crystal-clear and void of any smell, but has a peculiar briskness, roughness and bitterness, like Glauber's salts. It commonly sits pretty easy on the stomach, except it is weak or abraded, or drank too hastily, or in too great quantities, or immediately after or before milk. Where the taste is offensive to the stomach, causing reachings, belchings, loathing or vomiting, it is easily and quickly corrected by putting a little white wine or spirit of hartshorn to it, or making a whey of it, by putting half a  
pint



fore a summary of the chief may be sufficient.

1. This water curdles soap and milk.

2. Twelve ounces of the strong water of 1741 curdled eight ounces of boiling milk, and made a fine clear cooling whey. Sugar of lead, oil and salt of tartar, lime water, small soap-lees, potashes, sal sodæ, or this water mixed with Cheltenham, Scarborough, or Epsom waters, or with any other purging neutral salt waters, turn them pearl of a whitish colour. All these take off the rough sour taste of the water and make it drink sweetish and agreeably. The same does any of the alkaline salts or absorbent earths. After two or three days keeping this sweetened water is more disagreeable to the stomach, goes not soon off, makes it not so cheering nor exhilating; but a little white port wine put to the water takes off its taste. It goes better down from the acid in the tartar of the white wine joining that of the water.

3. Galls turn the water pale, clear, and bluish, but on standing three or four days in the glass it becomes green.

4. With a slight infusion of logwood it is of a purple colour.

5. So-

5. Solution of sublimite alters it little.

6. Infusion of fresh spotted armercius flowers, or of its fresh or dried capsulæ, turns it of a fine pale pink, as all vitriolics do.

7. An infusion of carnation flowers does the same ; if a deep purple, it soon fades.

8. The water shews no ebullition with spirit or salt of hartshorn, or oil of vitriol ; but a solution of its salt in water makes a violent fermentation with the former, and with all alcalis.

8. A solution of its salts in distilled water precipitates not silver out of its solution, but on standing a few days the mixture turns purple.

10. Its earth turns syrup of violets green by standing some days.

11. Seven parts Holt water, and one of lime water, with syrup of violets, turned, more slowly, from purple to a paler green.

12. This salt, laid on a red hot iron, neither crackles nor flies like common salt, nor flames like salt petre, nor swells nor blobs like alum and borax, but melts, boils, and leaves a white dry calx.

13. A mixture of three parts this salt, and one of Harrigate sulphur-earth, on pouring hot water on them, fermented as strong as



salt of tartar and lemon juice, and had the smell of Valerian root without the foetid quality ; but this might be accidental.

14. Rectified spirit of wine being poured on this salt, they emitted a more fragrant, refreshing smell.

15. Boiling water, poured on this salt in a china basin, fermented like salt of tartar, and juice of lemons.

16. Rub four parts of this salt and one of pot-ashes in a mortar, put them into a tea cup, pour boiling water sparingly on them, and stir them. Then they will swell, foam and hiss much, and fall down in a white stiff jelly, if there is but little water. Six or seven ounces of boiling water, poured on half an ounce of this powdered salt has the same effect, a large sediment falls to the bottom and a clear liquor remains a-top. Cold water put to or poured on the salt, and then stirred about, raises no visible fermentation, but is very hard to dissolve.

17. When oil of vitriol is dropt on the earth it swells, foams and hisses for a little time.

18. This acid dropped on the salt turns it presently yellowish. Then it rises and blobs, smokes and swells. If there is much salt, it turns hot, and is of a leaden colour and smoaky.

19. From

19. From a pint of lime water put to eight pints of this water, no effervescence followed, but the mixture was of a pale whitish colour, and presently let fall a white slimy sediment. The water above was clear and sweet, but, after some days, turned nauseous like the other. This clear water, evaporated on a sand heat, had received no sensible addition from the lime-water, and, tho' the water was sweetened, yet its salts had lost none of its acid.

20. The sediment of this water will not incorporate with oil.

From these experiments, note, I. That the water contains an acid, 1, 2, 12, 18, 19, &c. II. That it has an alcali, 6, 10. III. That it has very little iron, nor is it quickly discovered, as in chalybeates, 3. IV. That the water seems to affect a neutrality, till its salts and earth are quite separated, 8. V. The acid appeared strong, 11. We see that this salt is none of the four in 12. VI. That it contains neither common nor muriatic salt, 9. VII. That its acid is fixed not volatile, united to its salt, not to its earth, 10. VIII. Though the fixed parts have both an acid and an alcali, and though mixed in the water, yet they are separable, 8, 14, somewhat resembling sweet spirits of nitre. 9, 15, shew plainly the vitri-



olic acid, being of the nature with oil of vitriol and boiling water. 10, 16, shew an acid, but, without boiling water, it parts with it with great difficulty. When, by repeated filtrations and much labour, it has lost its earth, it unites to the salt, yet some is lost. This is the reason why it dissolves slowly in cold water. But to have all the acid, it and its earth must be taken together for use, though a little of the coarsest may be separated by filtration; for oil of vitriol affects its earth very little, when all its acid is gone. 17. shews its acid is gone, and that the water has an alcali.

Whether the water is evaporated on a sand heat, or boiled over an open clear fire (especially in a large quantity) the sediment mostly separates into three parts. When it is near gone, a strong gluey matter sticks to the sides of the vessel, tough as Burgundy-pitch or bird-lime, and is inseparable till it is cold. Then it is clear, transparent and brittle like a gum, rough and acid; but, when powdered, light and white, like fine flour. It is the same with Clifton Spaw, the most alkaline water we know of in England. Though its salts crystalize, yet it is destitute of alum and marine salt. Still it, as well as this, passes under the name of neutral salts, though most unjustly; as that is a  
powerful

powerful alcali, and this a strong acid. If this water is boiled away in a brass pan, and let stand some hours, or all night, cold, the hardened, glutinous remaining substance turns very green; so will all future lees made of that sediment; but kept warm on the sand heat, it still retains its gluey nature. When all the water is near gone, and a little hotter, it makes a hissing noise, swells, bubbles, and emits a most horrid, urinous smell, the same as Clifton water sediment, when almost dry. The sediment at the bottom, separated from its earth, is the most rough, acid, and cooling I ever felt. It has the strongest fixed acid firmly attached to it. Under this is a little coarse earth, clay, and sand.

When the water is slowly boiled away, in a bright brass pan, over a clear fire, in a small quantity, those things appear not so plain. It turns the brass blackish; the sediment (especially if the water is strong), is often grey and cruzzled, and leaves a salt brownish powder below. It makes the like noise (from its selenites) bubbles up like a strong soap-lather, and sends out the above urinous steam, and discolours polished iron put into it to stir it, or held in its steam. When this sediment is dissolved in distilled water, the earth often parts into white or grey flakes, which, when taken



out, washed and dried, do not much ferment either with acids or alcalis. This earth regularly separates from its salts and acid. Then it is insipid ; but the acid keeps still united to its salt, and they are difficultly parted. They are acid and bitter, even after many solutions and filtrations ; and as by those they are weakened and lost, so is the specific principle, till it be reduced to a common neutral salt. A solution of this salt, from the first filtration, turns an infusion of fresh armerius spotted flowers a fine pink, which it does not with alum when it has lost its vitriol. When a filtered solution of the salt is boiled up to a lee, it is muddy, curdles, and is of a light colour ; but if boiled in brass or copper, (which it never should be for inward use) it is greenish, from the strong acid corroding the metal, and leaves a downy rough earth insoluble. If this filtered lee is boiled up strong, and set in a fit fixed place, it projects its paralellogram crystals very soon, of the same prismatic figure with Lister's sal calcarium ; the same with that of the neutral salts in purging mineral waters, without any alum ; for these two (nor any others of different genuses, as I have often tried) will never unite together so as to form regular crystals from both. A strong solution of this salt in water coagulates milk,

and

and slightly thickens blood and bile, of a whitish, starch-like colour. It considerably shortens fibres of flesh, cut length-way, and put a few days into this solution, if strong enough, either totally prevents its putrifaction, or, if weaker, retards it a long while; or, if the flesh is much putrified, a pretty strong solution of it both sweetens and restores its firmness. This is a peculiar property, which neither alum, marine, nor any other of our natural salts, has, and constitutes it the most antiseptic we have. Though it is of a coagulating nature, yet, from the natural heat and circulation of the blood, and action of the vessels, I have known this water of singular service in a fizy and inflammatory state of the blood, as in inflammations, rheumatisms, chronic agues, cachexes, &c. Even saltpetre itself, though destitute of this antiseptic property, and not so cooling in snow, by five degrees in Fahrenheit's thermometer, yet surely throws some lentor on the blood in hæmorrhages. Nor is a course of this water less eminent in scrophulous inflammations of the eyes, when mercurials have failed. It has also a superior bracing power, preventing abortions, being drank daily as an alterative, from the second or third month after conception, to the beginning of the



the seventh, whether the danger of abortion proceeds from a weakness, laxness, or turgescence of the uterine vessels, &c. To delicate persons, the water is made more grateful, by adding sweet spirit of nitre and syrup of violets, or of corn poppies. Cold and phlegmatic bodies require something more warming to be added.

If a large quantity of this strong lee is set in a cool, steady place, it soon projects its crystals, which being repeatedly taken out and the lee boiled up again, it yields all its crystals in a dry summer, and leaves a little white scaly dust, which is a small selenitical earth, which had passed the wide loose pores of the filter, and was inadvertently taken at first for alum. All the crystals are parallelograms. Sometimes in winter, in a very moist air, a lee was left that projected no crystals. This in time dried away to a loose, floccy down, somewhat bitter and acid. The first crystals from a very strong lee, when dry, soon fell down in a white dust. A weaker lee slowly projected more firm and durable crystals. I have seen its lee send out fine indented, serrated crystals. If a lee is overcharged with alcalis, it gives no regular crystals.

That I might find the difference of the fixed parts of this, or any other water, boiled away  
over

over a quick, clear, brisk fire, and evaporated in glass on a sand heat, I took an ale-pint of this water, which, by the former method, left 67 grains of dry sediment, by the latter 74. In 1740, when the water was not publicly known, not willing to lose the waste water, many scores of gallons of it were boiled away, and the salt and earth separated. The former being dissolved in the like quantity of water for use, but stripped of its earth, answered not the end. But when the dry sediment of this boiled water was taken out and cold, all its pores were full of yellow dust, like sulphur, and even smelled of it. The salts became yellow by keeping. Half a drachm of them, sprinkled on a live coal, burnt with a bluish twinkling flame, after the white flame of the blotting paper was over. Thus it is not to be expected, that a mineral water will answer the same intentions, after the natural nexus, or union, of its parts is broken or decomposed. In the memorable drought of summer 1741, one pint of the water, boiled away, left 70 grains of sediment, which is nine drachms and a half to a gallon. In the excessive rains of 1739, a gallon of it left nine drachms of sediment. These were the great differences taken notice of. The difference of the proportions of  
earth



earth to salt, was from one third to a fourth part.

Boiling the water away over an open fire, in vessels of different materials, was taken notice of in the Institutes. As to wasting water on a sand heat, in a black glazed earthen dish, used four times, two ale quarts of this fresh water used each time, the first left four drachms and a half of dry sediment; the second left five drachms; the third and fourth left five drachms and ten grains each time. An ale gallon, evaporated in a new-glazed yellow pipkin, left an ounce and twenty grains of sediment. A gallon, evaporated in the first black dish, left only eight drachms, or one ounce. Another gallon, evaporated in the same dish, left nine drachms and twenty grains. Four several evaporations, of two quarts each time, in a glazed, rough, earthen pot; the first left half an ounce, the second left twenty grains more; the third, thirty grains more; and the fourth left five drachms. Five quarts, evaporated in a clean, new-tinned pan that had been used before, left ten drachms only. Two quarts, evaporated in glass, left near half an ounce. Two quarts taken out of a barrel, which had stood two months corked up, evaporated, left four drachms and ten grains. Seven quarts,  
that

that had stood two months in an open vessel, evaporated, left fourteen drachms of sediment, nine whereof were salt, and five drachms earth.

We shall now proceed to a few trials on boiled water. Two quarts of water that had stood two months in the close corked barrel, boiled away, left near half an ounce of sediment, whereof eight scruples and a half were salt. Two quarts of that water that had stood two months in the open vessel, boiled away, left four drachms and twelve grains of sediment, of salt ten scruples, and of earth three scruples. Two quarts of fresh-dropped water simmered away slowly, over a clear fire, left four drachms and twenty grains of sediment. Four quarts of fresh-dropped water boiled away quickly, over a brisk, clear, wood fire, left seven drachms and twenty grains of sediment. Six quarts of November (1757, when the spaw dropped only twenty gallons in twenty-four hours) strong water, boiled away, left twelve drachms of sediment, whereof eight drachms and forty grains were salt, the rest earth.

Hence note, 1. That twelve gallons and a half of water, evaporated on a sand heat, (besides the imbibitions of sundry kinds of vessels) left full sixteen ounces and a half of fixed parts,



parts or near eleven drams to each gallon of water. By boiling little above eight drams; by simmering, or slow evaporation, there were thirteen scruples to half a gallon; by quick, strong boiling, only eleven scruples.

2. There is a considerable difference between the quantities of fixed parts, left by evaporation on a sand heat, in the several sorts even of glazed earthen vessels; the matter, texture, cohesion and solidity of some being more than those of others. In their composition some earths are more loose, soft, porous, or less or more burnt, than others.

3. The less or more frequent use of earthen vessels, in evaporation, causes another difference, as the open pores of new or soft dishes require more earth to fill them up at first, than they do after often using. The more porous, spongy, the less burned and glazed dishes are (especially when made of improper earth) each time they are used they absorb some of the contents of the water, till their pores are filled; but hard, black or yellow, smooth, solid, well-glazed dishes, take in fixed parts at first, and each time less after. Hence glass and porcelain are best for evaporating water on a sand heat; some earthen vessels being mere filters to imbibe and transude salts.

4. Water,

4. Water, that has been kept some time in wood, leaves less fixed parts when evaporated on a sand heat, or boiled away, than the same water fresh taken up, the wood absorbing some of both its salts and earth.

5. Water that has stood long in a fit cistern and vessel, in a cool, moist place, when evaporated, leaves a little less fixed parts than the same water caught fresh at the spout, though some of its finest watery parts may be boiled away.

6. We see a visible loss both in the kinds of vessels and manner of preparation, as well as in the different seasons of the year and weather, or state of the water; but this loss is chiefly of the saline part.

7. We see that a great drought does not always enrich waters, that contain much saline parts; nor rains and wet weather weaken that principle proportionably. For the former, by scarcity of water, may suffer the salts to dry, harden and cruzzle in the earth, which the latter moistens, dissolves, and brings into the water, which, though its quantity be increased, yet is the salt dissolved, and brought into the water.

8. Yet if a water has (as in this) a peculiar, incolligible principle, not vestigably increasing or decreasing, in proportion to the several quantities



tities of water discharged ; this, being always the same, will be stronger in a small quantity, and weaker in a much greater, though the sensible vestigable parts vary not so much. This is the case of simple chalybeate or sulphur waters, which rise not from a great depth in the earth ; they are weaker and worse, and have not the same effects during and immediately after a rainy wet season, as in and after a drought.

9. From the salt obtained, in 1740, from boiling away large quantities of this water, and separating the salts and earth of the sediment, the former had not the same effects as when all the parts of the water were combined. For the peculiar principle of this water (*viz.* its acid) being strongly united to its salt (not its earth) was so strong, that it would not sit on the stomach, in a dose of above ten or twelve grains. Again, the salt, without its corrective, the earth, did not answer as a drying, healing astringent. The earth without the salt was no antiseptic, nor successful in bilious cases. The experiments were made, and sufficiently verified on the bodies of brutes ; therefore the only way to expect relief from this water, is by drinking it, with all its parts mixed.

10. As

10. As from all those various examinations of this water by tincturing, salts, &c. by evaporating on a sand-heat, or quick or slow boiling, from the spout or cistern, barrelled, open, bunged, corked, or stood long exposed to the air; in all these we find very little difference in the water. Then it follows, there is no reason to seek or expect any volatile principles here, and that that difference, observed by the drinkers at the spout or cistern, and when carried to a distance, arises from the simple element and the elastic air in it, which is common to it with all spring water, which drinks better and more agreeably at the spring or fresh, than when kept or carried.

11. That even strong water, by long standing exposed in an open vessel, affords a little less salt, and more earth in proportion, than weak fresh water taken up and boiled away.

12. In all well-dried sediments, when dissolved, and the salts and earth separated, and the water in the lee evaporated, the dried salts and earth taken together, weighed somewhat more than the dry sediment before solution. This addition was supposed to arise from the common water wherein the salts were dissolved.

M

13. It



13. It is remarkable, that when this water is evaporated either on a sand-heat, or over an open fire, in a large quantity, its pure, clean, well-prepared dry salts, turn often from a pale to a yellowish colour; but the salt from a weak water has a clear white salt, less rough, acid, and antiseptic, inclining more to the purging neutral salts.

14. Thirty-four ale gallons of water, boiled away in a new tinned iron pan (at several fillings up) over a clear fire, to thirteen quarts; the white, fine, silky, greasy-like earth thrown down in thin, snow-white cakes, with constant, loud, rattling noise in the boiling; being taken out, well washed in rain water, dried and weighed, gave six ounces, white, soft and tasteless. The hydrometer set in this lee, stood at 66. This lee on the sand-heat, evaporated to dryness, left sixteen ounces of dry, white sediment, only ten grains whereof were earth. This dry sediment dissolved, filtered, and evaporated again, weighed considerably heavier.

Eighty-five ale gallons of this water boiled away in a set boiler, precipitated with the like rattling noise, great broad white flakes of the like earth, which taken out, washed and dried, weighed eleven ounces and a half.

A large

A large quantity of this water, boiled away slowly, in a clean, bright, often-used, iron furnace pot, afforded the like white soft earth, and the most beautiful salt of all the preparations hitherto, a charming pale yellow, like fine *ens veneris*. A little of this salt dissolved in warm rain water, with a grain of powdered gall, has a strong chalybeate taste, and lets fall much leaden, blackish sediment. Quere; Would it not be a great improvement of this for cachetic, leucophlegmatic, cold, sluggish, gross bodies, to boil, or evaporate this water in bright iron vessels?

From a great variety of experiments, and observations therefrom, these may be of use.

1. Galls not turning a mineral water pink, claret, pease bloom, black, blue, or atramentous, is no certain sign that it is destitute of ferruginous matter; for either this matter is too little, as in hard waters, that at the spring both smell and taste of iron, yet galls affect it not; or the acid may be too strong, and keep the scantling of iron in a state of solution, as in this.

2. All the vitriols contain less or more of an irony matter.

3. Solution of blue vitriol with gall, is of a green, or yellowish green colour; yet tho'



there is a green colour with galls, it is no infallible proof, without other corroborating signs, that a water is alkaline.

4. That Nevill-Holt water contains some ferruginous earth, is evident from the small yellowish brown ochery matter left on the surface of the moist ground below, and from the sludge left in the other exudation near the spaw.

5. That it contains a vitriolic acid, is visible from a solution of its salt with gall turning purple or purplish. But in a solution of fixed green vitriol with gall, when its sediment is precipitated, the liquor is always a dark blue, and the sediment less in proportion to the iron matter contained in it, as in green copperas, Hartfield and Shadwell waters.

6. The affinity between green vitriol and alum (being from the universal acid, and differing only in the glebe to which they are joined) either of them is seldom found alone and pure; for great art and care is required to separate them in making alum.

7. In preparation, either of those salts may be so accompanied with alcalis, that we can see no visible appearance of alum in them. Some fresh chalybeates, at the spring, discover a *minera ferri*, which, by standing, keeping,  
or

or carriage, seems lost, as has been long and generally believed; but, on the contrary, is often hid in calcarious and absorbent earths, as was shewn in the institutes. This is fully demonstrated,

1. From the possibility of instantly throwing in any third thing, which the *minera ferri* attracts.

2. When thus, or by flying off, the *minera ferri* seems lost, by adding what may restore or set it at liberty again. Hence the reason why,

1. Such waters, when kept or carried, have not the like sensible effect as at the spring.

2. Why chalybeate waters bear keeping and carriage much better than others.

3. Why, of chalybeates equally strong, some retain their iron pretty well, others not; and even some but indifferently impregnated do both.

4. Why a chalybeate water will bear keeping and carriage better at one season than at another.

5. This also shews the weakness, or prepossession, of those who pretend to confine the chalybeate principle, by covering the top of the bottled water with oil under the cork,



and such other stratagems as serve only to amuse and deceive.

6. Here we have a further plain reason of the several colours of chalybeate waters with galls, why one is pease-bloom, another pink, red, blue, claret, or atramentous; why some strike their colours quickly, others slowly. But all these are explained in the Institutes.

7. There are waters whose salts give no indication of iron or vitriol with galls, yet are chalybeates not void of iron.

8. The calcarious, sulphureous, and brine water salts, give no signs of iron and vitriol, though some of them are produced by them.

9. Some experiments made vitriol and iron much more visible than others, according to their several quantities, and according to the different nature of the vessels in which the waters were evaporated.

10. There may be observed a considerable difference, as the Nevill-Holt spaw discharges more or less water in the same space of time and season. When it drops least it has most acid; when it drops fastest or runs, most salt, in proportion to the quantity of water it runs off, as we saw in the May and November waters of 57, and the January, February and March waters of 58.

11. Here

11. Here is proof that the slow motion of water is not the cause of putrifaction; for what spring can be slower than this?

12. Crystalized salts give not near so good a tinge with galls as the uncrytalized; therefore they leave behind them much of their peculiar efficacious parts. For nitre, or neutral salts, admit no other into the regular crystals, only this inseparable acid; but that part of this ingredient, shut out by the crystals [earth excepted] though by far the least, is yet the specific part of the composition, and salt is greatly impoverished by the want of it, as both experiments and practice have found, to be the **great, antiseptic, antiphlogistic, and bracer.**

13. Therefore this water should neither be evaporated nor boiled with too great a heat, nor its salts crystalized or purified too fine; neither is its earth so cooling and astringent, for the loss by all these does irreparable harm to the medicine.

14. Here we see, that saturating this salt with alcalis, turns it more to a neutral, makes it milder, softer and smoother.

15. Since the proportion of vestigable fixed parts, from twenty to two hundred gallons, except in land-floods; but the incolligible (though not volatile) are greatly lessened; then



this spaw sends out two fundry kinds of waters, one smother, softer and milder, fit for weak, delicate constitutions, yet preferable to the best calcarious waters with their neutral salts, as it still retains something more cooling, binding, bracing and antiseptic. Another more rough, harsh and bitter, fit for stronger stomachs and robust bodies.

16. Decoction of logwood proves both this water and salt to have a fixed vitriolic acid ; for with the water it is of a bluish purple ; next day it is a deep scarlet red, with a small sediment ; but with the salt it is an opaque blue. This and galls, as well as several other experiments, shew that it contains a *minera ferri*, or iron, which it must have, as it strains through a large thick stratum of clay and blue marl, mixed with abundance of iron marcasites. This is also evident from the deep bluish marble colour, which its diluted tincture gives with gall, and the large bluish purple sediment precipitated thereby, like strong, fresh chalybeate waters, which contain much alkaline, calcarious, or absorbent earth, hiding the iron or vitriol ; and likewise from the water sometimes tinging pink or red with galls ; and from tinging the accustomed drinkers mouths, throats, &c. black ; and by comparing the  
quantity

quantity of its salts and sediment by galls, with other sediments procured or precipitated from good chalybeate or vitriolic waters, which contain only a mere scantling of this mineral, such as Shadwell, whose water, from the spring, is a deep colour of sack, and with gall a deep transparent blue, throwing down a small ocher-coloured sediment.

2. From several experiments it clearly betrays a vitriolum martis. Hence some cause of that urinous smell, near the end of evaporation or decoction, proceeding from the dissolution of the connexion of a volatile alkali bound up in the fixed.

3. It is also plain from its sediment (when the water is near spent) turning thick and tough like bird-lime; from its difficulty to be dried, and its easy softening and dissolving again by a small heat.

4. From some of its powder, when dried over the fire or on a sand-heat, turning of a greyish colour, like vitriol calcined till its flame is gone.

5. From its dark-brown colour, melaginous consistence, and sweet smell, like warm honey or molosses. These four last symptoms are never perceived but when the water is  
boiled



boiled away, in a large quantity, over an open fire, in a great boiler.

6. From this dry powder being dissolved in warm water, and dropping down a yellow sediment, which is its metallic part, set at liberty from its attachment to the saline.

7. From the lee not wholly crystalizing, but leaving a mellaginous substance, not easily nor readily dried, and which continues opaque, not transparent nor homogeneous, but a heterogeneous mixture. As often as this sediment is dissolved, it still leaves a small mellaginous substance not to be crystalized; for having lost its metallic part in form of an earth, the crystals are more pure and simple, have their most valuable principle much impaired; when it lets go its ferruginous parts it soon quits the water, for vitriol has much saline fluid retarding their motion, by the intervention of fixed metallic parts. But when water is put to them, they are set on motion again. Yet, on rest, the metallic parts get loose again, and subside. Several kinds of vitriol are brought to us in water. But water is always necessary to make the acid of sulphur assume the form of vitriol and quit the metal; for no salt can exert its saline power till it is moistened or dissolved by fire or water; nor can vitriol ever  
be

be brought to crystalize without water. Hence then we have a clear proof of sulphur, since it is salt that dissolves iron and copper.

7. It resembles vitriol, from the constant pale yellow, or colour of *ens veneris* in its salts, obtained from strong water in a dry season, when a large quantity of it has been evaporated or boiled away, before crystalization.

8. From a solution of its salt with galls, before it was crystalized, or a solution of its sediment turning blackish, blue, purple or pink, even sometimes when the liquor above was clear. Here see their mistake who deny the existence of fixed vitriol in any mineral water, where the open air has not free course through all the strata of earths. This is further seen in Hartfield and Nabbs waters. It shews also the weakness of those who pretend to give us the principles of all mineral waters from a few trite experiments, in a fine dress.

Nor can somewhat bituminous be denied to be a principle in this composition, since vitriol has the same matrix. The proof of this is no more needful than that of *minera ferri*, since vitriol must always have a metallic glebe joined to it. Only it appears that there is much more of this in this salt, than in green vitriol. Its inflammability too gives strong suspicions of sulphur,



sulphur, since set in a crucible along with other salts, it presently fills a whole glass furnace with furious blue suffocating flame. It appears also from the yellowness, hardness, crispness and friability of its filtering caps, through which much strong lee had been filtered. Also from the waters having the same effect when drank in a humid asthma or profuse expectoration, as strong sulphur waters have, viz. drying and thickening the phlegm, stopping spitting, and shortening the breath. But besides the acid of vitriol or alum, meeting with a fatty earth (such as the soil about the spaw is) and oily vegetables, forming inflammable matter. Another principle really existing in the water, though more incolliable, is truly a greater share of fixed acid, than the salts of our purging waters partake of, or any of our natural salts. Hence its sour, rough taste (together with the bitterness of the neutral salts) an acid that makes its earth almost neutral, so as very few acids affect it, scarce oil of vitriol: so manifest and perceptible an acid, as that a solution of this salt in warm water, with alkaline salts, raises a strong fermentation, with smoke, heat, hissing, foaming: an acid that affords a strong acid spirit, which alum does not, till after the alcalis are

are added : an acid that absolutely prevents the salts making glass or soap : an acid that, in one night, from a strong lee from ninety gallons set in the middle of a large kitchen, pierced through brick and lime, covered all the faces of smooth irons lying flat on the cover of a sand-heat, whereon several pounds of lees were set to dry, though covered with brick and lime laid on iron bars : an acid that, when a dish of warm salt was taken off the sand-heat, and set all night in a dining-room window, tarnished all the metal furniture about the chimney and table, yet an acid which of all others comes nearest the nature of vegetable acids, especially tartar. A small quantity of this salt coagulated not animal juices more than nitre. A very little of it has been observed to resolve rather than thicken fizy blood, which distilled vinegar, sweet spirit of nitre, and acid of tar coagulated.

It was also tried to evaporate some of this water in summer by insulation in wide shallow glazed brown earthen dishes, upon the church leads, under nets. In dishes and tin iron pans the acid in the water penetrated both, and brought the iron into the water, made it red, thickish and earthy. The earthen dishes imbibed the salts of the water. Several comparative



parative experiments were also made between the waters of the old and new exudations. Both were found to contain the like principles, only the former afforded much more water, and that water had most fixed parts. The latter was more acid, and its ferruginous part more visible, but both were fixed. But take it more particularly.

This new exudation, twenty yards from the spaw, was only in a little hole about six inches over, and twelve deep. This hole was half full of water. On the surface of the ground about it, and under the roots of the grass, was a loose, spongy, reddish brown, ochrey matter, two inches thick, and under that a thick strong hard clay. The water was very clear, and covered with a thick scum, all the colours of the rainbow. It had a strong vitriolic taste, but nothing of the sweetish taste of alum. Green tea turned it bluish; and gall to an opaque bluish black. It soon curdled and let fall a sediment of the same colour. The liquor above the sediment was very transparent, with a small purplish cast. A bottle of this water being taken up, and the hole cleaned well out, and full again in three hours, the water was clear, less harsh and disagreeable. Powdered gall mudded it at first; but when it had stood

stood three hours and settled, it turned blackish blue, rather deeper than before, curdled more, and had a larger sediment, and tasted vitriolic. But on four days standing it altered not; a pound and a half of this water, evaporated on the sand heat, left sixty-four grains of snow-white, soft, silky sediment. As much of the first water before the place was cleaned out, evaporated, left the same. As much of the spaw water, evaporated the same day, left near four scruples of the like sediment, but had not so strong a vitriolic taste.

From many comparative experiments on those two waters, there appears some little difference. The new water is much rougher and harsher. Galls and astringents tinge it blue and purple; whereas galls only give the old water a bluish cast, but when let stand two or three days its colour is green, like the calcarious purging waters. It affords near a fifth part more fixed parts than the new; but neither of them afford at all times the same exact quantity of fixed parts; nor, as far as I have experienced, do I think any other waters having much fixed parts do, except they arise from an immense depth in the earth; for, from the many mines and subterranean caverns which I have visited, rain waters seemed not to penetrate



so deep as many imagine. The water of the new exudation and its fixed parts discover a stronger phlogiston, or *minera ferri*, from which vitriolic acid, phlogiston, and sulphur, are generated; this, though not so sensibly perceived by smell or taste, is probably a principle in this water. But the vitriolic acid having subdued much of the alkali in the earth, it is neutralized. Hence the talc and selenites, which are the far greater part of its earth, together with its yellow and vitriolic petrifications produced by the phlogiston, afford the chalybeate principle, whilst the absorbent earth and vitriolic acid generate the selenites and talc. From those vestigable principles may be derived the composition of the sensible impregnating parts of this water. But the exact proportions of each of those parts, I pretend not to determine, not being dextrous enough to catch and fix, measure and weigh either the acid or phlogiston. Neither do I pretend to determine whether there are more parts besides these, or what are insoluble. Yet from them is derived that rough, acid, bitter taste, taken falsely for aluminous salt, though it projects the same crystals with the purging neutral salts, and a white, soft, silky, greasy earth.

1. Hence

1. Hence see again how near different waters may rise up to one another.

2. Also from what their seeming differences do arise.

3. That most, if not all of our mineral waters seem to be impregnated, and arise from no great depth in the earth, as I have often observed in searching far below their impregnation; and perhaps metals reach not many hundreds of yards below the surface.

4. From hence the different effects, yea, the contrary effects, of mineral waters may be accounted for, when the whole aggregate of their composition is taken together. This is clear in arsenic, cobalt, &c. how many waters wash them? yet we hear of no poison in those waters, either because they bring their antidote along with them, or because these minerals are innocent in their natural state, or till they are decomposed. Besides arsenic is not a natural, but an artificial preparation from cobalt, fixed alcalis, and flints, and has not been known above 250 years. And as to cobalt, it is found in plenty in Saxony, Bohemia, and even in England, Wales, and no doubt in Scotland. Have these places no waters? Therefore Mr. Boyle's fear of our waters rising from those minerals is ill-founded.

N

5. Not



5. Not only are we hereby helpt to account for their different effects on our bodies, but also on different constitutions. And the small exudation (which in that state then seemed not to yield above three or four gallons of water in twenty-four hours) seems the greater bracer, antiphlogistic and antiseptic, though more disagreeable to taste and the stomach.

6. Here observe the wonderful penetrating nature of those salts, which extracted the *minera ferri*, out of the glazed clay vessels, iron through the tin, and of copper through tin.

7. This shews the impropriety of such vessels for extracting salts from mineral waters.

8. That iron seems fittest for evaporating this water, as it improves its chalybeate principle added to the salt, preferable to any officinal preparation. The salts find their way into the smallest vessels, mix as well with the finest as coarser juices, and thin when necessary as well as gently thicken the other, producing in proper cases good effects.

If the clear water of the new exudation was taken up fresh gathered and poured on powdered gall, the latter at first muddied it a little. But on standing two or three hours, small purple threads began to rise slowly from  
the

the bottom to the top of the water in the glass, and to gather there till the whole was an opaque black. This colour descended to below the middle of the glass, and left the water at bottom quite clear. When it had stood two, three or four days, the black liquor at top, poured off and diluted, was a beautiful transparent purple. Several other comparative experiments were made on these waters and their salts, in all which the new water was found the more vitriolic and ferruginous.

Further proofs of an acid in this water may be given, as,

1. It curdles milk and soap. All salts, acids, alkaline and neutral, do the same. But this water causes loathing, vomiting, sickness, and sometimes pains or gripes, if drank an hour or two before or after milk, and brings up curds in hard cheesy lumps; and where there is an acid in the first passages; or where the stomach is abraded or relaxed, except by acid humours.

2. With a fourth or fifth part boiling new milk, and warming them over the fire when mixed, it makes a fine clear whey.

3. It quenches the most parching thirst in ardent or inflammatory fevers.

N 2

4. From



4. From its abating the most burning heat in fevers and raising a moisture on the most dry and parched skin.

5 Its causing a whiteness, milkyness, curdling and precipitation with lixivial or fixed or volatile alcalis. These precipitations join the alkaline salts, and form a neutral.

6. Its pink or purple colour with armerius flowers. Its deep purple with carnation flowers.

7. A solution of the salt in syrup of violets turns first purple.

8. Its violent fermentation, despumation, swelling, foaming, and hissing on pouring hot water on three parts this salt and a fourth part alkaline earth, or lime water, or lixivial salts; or even hot water alone. Herein it resembles oil or spirit of vitriol. If the above signs are disputed or denied, perhaps the following may bring clearer proof, and also bring us to the exact quantity of fixed acid, either in this or any other water.

1. I took of this water fresh, as it dropt, two pounds, of hot boiling new milk half a pound, mixed them, and they soon curdled into small mealy-like curds and whey.

2. I took the like quantity of water out of the receiver (that had not been emptied nor cleaned

cleaned out during the three last winter months) and the like quantity of boiling new milk, mixed them, and they curdled like the other, into a mealy curd, and a pale, whitish whey. They continued the same after fourteen hours standing, only more separated.

3. The above quantities of boiling new milk, and the Old Spaw water, which had stood open three months, being mixed, no coagulation ensued immediately, nor in fourteen hours after. The like experiment was tried with the water of the New Spaw and boiling new milk as above. They had a large, white, hard, tough curd, and a whitish whey.

Next morning the same experiments were repeated, only the water was warmed to the ninety-sixth degree, and the new milk biled as before, each in the above quantities.

1. Four pound and a half of water, taken at the spout, evaporated till dry, the like quantity of fresh rain-water poured cold on the sediment, and sixteen ounces of boiling new milk put to it, and all well mixed, no curdling ensued, but all was a smooth, soft, even liquor. Yet, when warmed to ninety-six degrees, it broke a little, and the whey was of the colour of blue milk.



2. A quart of water out of the receiver, warmed as above, and of boiling new milk half a pint, mixed, instantly produced a hard curd and clear whey. Half a pint more of boiling milk put to it and stirred, it curdled presently with a whitish whey. In two hours all separated to a hard curd and clear whey.

3. Two pound and a half of the New Spaw water, warmed as before, when it had stood five months in an open vessel, and a pound of boiling new milk put to it and stirred, after two hours standing, mixed, the water remained white, with very little curd.

4. Two pounds of New Spaw water, which had stood all night, warmed, and fourteen ounces of boiling new milk being mixed, no coagulation followed, although the water had an undrinkable ferruginous taste.

5. Two pound and an half of Old Spaw water, that had stood bottled, corked and sealed three years, warmed, and of boiling new milk twenty-eight ounces, when mixed, curdled to a hard curd and clear whey.

6. Two pound and a half of rain water warmed, oil of vitriol twelve drops, mixed, and twenty-eight ounces of boiling new milk put to them; the coagulation, curds and whey proved the very same as the last. The oil of  
vitriol

vitriol was put in, drop by drop, at several times.

Hence note. 1. That it is not every coagulation of milk that produces a hard curd, or every state of the coagulator; for the first two soon produced a coarse mealy-like curd at first, then a thin whey at top.

2. We perceive a little difference between the water as it drops, and that in a full cistern.

3. That the water, by standing or keeping long in open vessels, loses much of its acid, which yet deserves not the name of a mineral spirit, as it is so long in flying off.

4. From the coagulating power of this water being weakened by being exposed some months to the open air, it seems to have a double acid, one semi-volatile, the other fixed to its salt.

5. From the milk put to the New Spaw water cold, making a larger, stiffer, and stronger curd, yet a white milky whey, tho' the water has so intolerably strong and irony taste, that scarce a common stomach can bear a pint of it, yet its fixed parts are somewhat less than those of the Old Spaw; so that a water may have this taste, yet have less acid.



6. We see with how much greater force the coagulative power of acids acts by warming the water; for what would curdle one fifth part of boiling milk cold, curdles to a hard stiff curd two or three fifths warm.

7. From the sediment of the water evaporated, and the same quantity of rain water put cold to it, not at all coagulating one fifth part of boiling new milk, till it was warmed, and but little then; we see the irreparable loss of some of the lightest finest parts in the water, and a diminution of its virtues by evaporation, to obtain the salts.

8. Hence it follows, that they that would reap the benefit of mineral water, should drink the waters themselves, in their whole aggregated mixtures undecomposed, by any chemical preparations to alter them. This is clearly seen in all the best plain chalybeate and sulphureous waters. For when the volatile acid, the solvent of the iron, and volatile alkali that dissolves the sulphur, are gone, what are they more than common waters, none of which are destitute of a scantling of earth and salt?

9. Though the principles of mineral waters should not be separated for the use of the sick, yet a strict judicious examination of them (especially

pecially where there is a considerable expectation from the fixed parts) is absolutely necessary that both physician and sick may know what they have to depend upon, and that they may be able to compare the contents and known effects of one water with another.

10. The whey of this water losing all its rough, harsh taste, shews it not to be aluminous ; for it is not probable that a little milk, white wine, or spirit of hartshorn, should destroy the taste or stipticity of alum.

11. The water, which had stood so long open, not coagulating milk, shews it not to be aluminous ; for alum, being a fixed salt, is not disposed to fly off.

12. The Spaw water, which had been carefully bottled, corked, sealed, and kept several years, when warmed, coagulating as much or more boiling new milk than the new-dropped water, shews that this water taken up at a proper season, and carefully preserved, sustains no sensible loss by keeping or carriage, therefore well adapted for long voyages and different climates.

13. Were alum, blue or white vitriol, in the water, all these, being fixed parts, might certainly be found in the sediment after evaporation, especially in the coagulation of milk, as they are so powerful coagulants. But the  
rain-



rain-water with the sediment did not coagulate the milk till it was warmed, and even then but faintly.

14. By this we plainly see to what quantity of the strongest mineral acid, the acid in any given quantity of this water is equal, viz. twenty-two or twenty-four grains of oil of vitriol to a gallon of water, above its natural degree of acidity.

15. Hence also we see there may be much acid in a water where there is small appearance of a ferruginous earth by galls; and that a water may taste strong of a ferruginous earth, yet have but little sensible acid; so that they seem to be two different things. But here appears to be a semi-volatile and a fixed acid.

16. Since this water, warm, stimulates, braces, and coagulates powerfully, no wonder milk and it cannot agree when warmed on the stomach.

17. Since moderate heat hurts not the water, it may be warmed immediately before it is drank.

18. Hereby we learn what, or how much of this acid is lost by standing open, or by evaporation, i. e. how much is inseparably united to its salt.

19. That

19. That the *minera ferri*, or phlogiston, is a very different principle from the acid, since a water may be very strong in one, and weak or wanting in the other. That this water contains a concealed ferruginous principle, is evident from the ochery, boggy surface about, and from the honeycomb-like concretions; from the many iron marcasites in its earth, and from its land-flood tinging with galls, &c.

20. Since we see it is so powerful a coagulator of milk, it is evidently improper where there is much acid in the stomach and bowels.

Since then there is a perceptible acid in this water, it remains to be enquired of what kind this acid is. It is very different from the acid of marine or muriatic salt, though they agree in several things; as if to a diluted lee of either muriatic or Nevill-Holt salts, a fixed alkaline salt or lee is added, they turn presently turbid or milky, and let fall a white sediment. Or if a lee of either salt and putrid urine are mixed, the like precipitation follows. Both acids corrugate our fibres and vessels; this accelerates the circulation, grinds down the juices, hastens their excretion and expulsion, hardens the solids, and prevents the putrefaction of dry bodies. The stomach and bowels are hereby much braced, the appetite whetted, digestion  
much



much promoted, and insects in the bowels destroyed. Both cleanse the skin from ulcers and corruption, and promote urinary outlets, yet strengthen the muscles in the neck of the bladder. They both resolve, discuss, cleanse, and open. Thus far they agree in part; but in other things they differ widely.

For, 1. The acid in Nevill-Holt braces far more powerfully than the muriatic, yea more than the Peruvian bark, but thins not the blood so much.

2. The muriatic coagulates all the animal juices; the other only gently thickens in a dissolved state of the blood, and puts a stop to its further colliquation.

3. The muriatic heats greatly, and increases thirst. This salt cools greatly, and either abates or takes off thirst.

4. The marine salt is best suited to cold, lax, foul, sluggish, inactive, phlegmatic bodies; the other is very improper for them, without a good allowance of red wine, but is fitted best to the bilious, sanguine, plethoric, dry, thin habits; that best adapted to the decline of life, this to the rise and meridian of life.

5. The muriatic is a greater drier, as it irritates the solids, promotes circulation and secretion; carries off and expels the thinner parts  
of

of the blood, both by skin and urine, yet binds the belly while the rest of the blood is thickened, and the solids corrugated; hence heat, thirst, and feverishness. But tho' the other braces the solids, and promotes circulation and secretion, yet it powerfully, and beyond other things, prevents and takes off all the bad effects of the former, viz. heat, thirst, feverishness, pining of the body, and gently loosens, gives the blood such a due consistence, that though circulation is stronger, yet it prevents or checks all immoderate discharges on one hand, and all hurtful retention or accumulation of humours in any part.

Hence they differ widely in their effect on our bodies. The one is highly improper in hot, dry, bilious, hectically disposed, and inflammatory constitutions. The other is wonderfully adapted chiefly to them, or where the tongue and mouth are in common dry, clammy and bitter; the urine hot, sharp, with a constant desire of making it; in sharp, tickling coughs, and rheums in the breast and throat, especially in ulcerous dilacerations in the lungs and throat; in slight inflammatory complaints of the breast; in habitual costiveness, a dry and crisp skin. In all these cases Nevill-Holt water has the preference, and the other waters injurious,



injurious, though a sovereign remedy in cold, phlegmatic constitutions, where the solids are loaded with moisture, and thereby become cold, inactive or sluggish. In relaxations (if not from a putrid, dissolved state of the juices), in hectic and schirrous disorders, Nevill-Holt water is of most eminent service. Also in all cases where the blood is faulty, in acrimony, fluidity, viscosity, or disposed to a putrescent state, or alkaline; or the vessels weak, thin, abraded or relaxed. But it is by no means suited to gross, cold, infirm, dull, sluggish, inactive, dropical habits, except in the beginning of those disorders, where they may be drank moderately and regularly along with exercise, temperate use of red port-wine, warmers, diuretics, and laxatives now and then given. Nor are they to be advised or prescribed where natural, necessary, or customary evacuations are obstructed or diminished, as menses, piles, fistulas, &c. or where there are large stones lodged in the kidneys or ureters; the shaking, shifting, moving or displacing of which may be dangerous or fatal. Or to those whose life and health depend on an habitual, plentiful expectoration; or where there is a sensible acid in the first passages to the stomach; nor to the

the aged, except of sanguine or bilious constitutions.

This water contains not the acid of sea-salt, for that turns iron of a colour between yellow and green, and has a blackish sediment; with copper it is a fine emerald colour, and by standing becomes obscurely brown.

It is not the acid of nitre, for with iron that is a colour between yellow and reddish brown; and with copper, a pale sky blue. That it is not the acid of copper, is hence clear,

1. Neither the water, nor its salts in rain water, give any tinge of blue.

2. A solution of its salts would be a pale sapphire colour.

3. It would turn the blood bluish; whereas, like nitre, Holt salt brightens the red colour of the blood: these and many other differences are well observed by the ingenious Dr. Lucas.

It has been, and is still, the constant objection to the use of this water, that it contains alum; yet the objectors have never yet made it appear, by any proper methods of examination or investigation of the water, except the small white flosculi lying between the dry crystals be taken for alum, as at first they were, by mistake.

But



But as this has been the grand objection to the use of the water, by some, whose liberal education, searches, studies and knowledge in chemistry, if rightly applied, might have entitled them to a better acquaintance, and clearer understanding of the contents of mineral waters ; it will therefore be necessary to insist the longer on this point, in order to clear it from all cavils and objections of this sort. The whole visible fixed parts of this water, being a peculiar sal-calcarium (not of the neutral kind) of a very acid, rough, bitter taste, and a white, silky, floccy, greasy like earth, like fine white flowers of benzoin, (while it is new-freed from large quantities of water evaporated or boiled away, but by keeping it falls down into a whitish grey powder) it is almost neutral when the salts and earth are fully separated. Acids or alcalis affect it little, only oil of vitriol sometimes ; this earth being what affords talc and felenites, with a very little calcarious earth and sand or marl. These are all the fixed parts we find. Some loads of this talc or felenites were brought up in digging up the hill, building the arch, and fixing down the receiver, gathered and carried away and given to both brutes and men, to check or stop obstinate or dangerous diarrhxas,

or

or dysenteries, for gripings in the bowels and bloody urine, being somewhat of the nature of Neuham's magnesia alba prepared from slack ed lime, spirit of salt nitre, in imitation of Hoffman, who first published it, and (first taken from Stahl) when it had been for some time kept a secret, and sold at a high price. True, indeed, the water, but especially the salt, has a most harsh, acid, bitter taste, which, though it may resemble alum in some things, yet differs widely from it in others, which prove it destitute of alum.

As, 1. Who ever observed alum to cure habitual costiveness? But this, if drank in a moderate quantity only, keeps the body open. Yet it should never be used for a diarrhæa, in the end of a consumption.

2. Who ever observed alum to be a powerful diuretic, a cleanser of all the urinary passages from small stones, gravelly matter, sand, sludge, and mucus? But this water is most powerful, and has cured many in a lapidescent disposition of their blood.

3. Who has found alum a great cooler and antiphlogistic, beyond nitre? But I have seen this salt and snow lay the mercury in Fahrenheit's thermometer, five degrees lower than nitre and snow; and in most ardent and in-

O

flammatory



flammatory fevers, a whey of it allays both heat and thirst far more than nitre.

4. Was ever alum noted for being an effectual embalmer, either to prevent or remove putrefaction? But abundance of experiments have sufficiently proved this to be the most powerful of all salts, not only in preventing putrefaction, but in restoring to sweetness and firmness substances that were most intolerably foetid, and become a kind of soft mucilage.

5. Is alum a thinner of a buff-like, viscid, fizy blood or serum? But this salt has herein had great success, as in chronic agues, obstinate, inflammatory rheumatisms, and even on viscid, fizy, buff-like blood, which wanted heat, motion, and the action of the vessels. This salt has often been found a gentle thickener of a loose, resolved blood, and restored its due, natural consistence. Such contrary effects have mineral waters, as Hoffman well and justly observes at large.

6. Has alum been found a corrector of putrid, bilious or acrimonious blood? But this water has been noted for such in many cases, during many years.

7. Will a little white-wine, spirit of hartshorn, or making a whey with a solution of alum, wholly take off the taste of alum?

But

But they entirely take off the taste of this water.

8. This salt has only a rough, acid, saline, bitter taste ; but with these alum has a sweetish instead of a bitter taste.

9. All acids (alum excepted) being saturated with alcalis or absorbents, lose their acidity, and become inoffensively salt and bitter ; but alum still retains its rough, stiptic taste, after putting in the kelp and urine, &c.

10. Alum is produced of a hard, flakey and slate-like stone. From such we have all our alum in England, and it is always joined to much sulphur and vitriol. Calcination carries off the former, and the alcalis put in destroy the latter. What was here formerly taken for alum-stone is the above blue, flakey marl, which answers the same end as fuller's earth.

11. Where are the alum works in Britain, where the alum is, or can be got out before calcination ? But here, we are sure, are neither subterraneous fires nor furnaces.

12. For what end are urine and alcalis put to a solution of calcined alum ? Is it to destroy the vitriol or alum ? But do alcalis, put to a lee of Holt salt, turn this salt to alum, which it must do was it alum ? Or will these alcalis



turn a solution of alum to a purging neutral salt?

13. Where is the alum whose solution projects only hexagonal, paralellogram, prismatic crystals of salt? But this salt does, therefore it is not aluminous.

Thus it is evident, that though this water has a strong acid, it is neither that of sea nor muriatic salt, nor that of copper, nitre, nor alum.

1. This salt has the true saline bitter taste, peculiar to purging neutral salts, as well as the acid which the others have not.

2. Herein alum, Holt and Clifton agree, in sending out their urinous smell when almost evaporated, but the first not before the alcalis are put in. The other waters send it out without any addition.

3. Alum-stone must either be calcined, or laid some time on heaps in the open air. For when taken fresh out of the earth, neither its powder, infusion, nor decoction, taste the least of alum, so firmly does its sulphur attach its earth and salt, that only a calcining fire can dissolve their union. But at Holt is neither heat nor fire to decompose it if there was alum. Nor are there any hot, scorching grounds, like those about Puteoli, to produce alum.

4. Alum

4. Alum has alcalis put to it, both to destroy its vitriol, and make it project its octagon crystals. Holt water projects its parallelogram crystals without any addition. Nor does it shew the least appearance of alum, only sometimes a white plumaceous scaley dust or earth lies interspersed among, or, when dry, under the nitrous prisms, which was, upon the first superficial examination, taken for alum, but was indeed some small selenitical earth, come through the loose pores of the coarse filtering cap.

5. As was hinted above, both shop alum and native alum, without alcalis, thicken the animal juices into a stiff, hard, porous crumbling mass; but a moderate quantity of Holt-salt only throws a lentor on them, much the same as nitre or salt of tartar; yet it resolves the fizy buff-like blood in chronic agues, or arising from old surfeits or debauches, by bracing up and enabling the solids and vessels to act over the fluids with greater force. This experiment has often been tried and found successful both in coagulated and circulating blood.

6. Alum has an austere, stiptic, sweetish taste; Nevill-Holt salt a rough, acid, bitter taste.



7. Alum encreases heat, thirst, dryness of the mouth and throat; but this salt and water take off all three. Hence in a saline, acrid, bilious or putrescent state of the fluids, or in intense, ardent fevers, with a rapid, high pulse, stammy urine, great heat, parching thirst, dry, black parched lips, gums, tongue, mouth, throat, and hot stomach; there is no drink comparable to this water or its whey, no, not the justly famed decoction of nitre. For after a day or two drinking, its surprising good effects will be visible to the beholders, and comfortable to the patient. It keeps the belly open. At the same time, a troublesome looseness may be prevented by putting diacodium or syrup of corn poppies, with a little tincture of japan earth and sweet spirit of nitre to it, which will give it a pleasant vinous taste.

8. Neither nitre, native nor common alum, green vitriol, fixed, calcarious or neutral salts, nor true sal muriale in small quantities, prevent or recover from the most foetid putrefaction. The property of doing both is peculiar to Nevill-Holt salt alone. This has been tried hundreds of times, on the most foetid, extravasated animal juices and circulating fluids, in living bodies, both in a highly bilious, dried, or putrescent state of the juices, when the foetor

tor and breath of the sick, and all their excreta, have been almost insufferably foetid, as well as their sweat and urine ; and sometimes their skin all mottled over with leaden, brown, or livid spots. But here again this water should be used, by giving small anodynes along with it, or a little red port-wine burnt with cinnamon and a bit of sugar. This both supports the sick and prevents a looseness, while the water, as an alterative, corrects the putrescent humour, restores the nature and sweet state of the blood, braces the relaxed solids, and removes the putrid, acrid, bilious taint of the juices. All this it does more effectually and safely than the artificial mineral acids, or aromatic, acrid, alexipharmic, heating vegetables, bitters, vinous spirits, gums, and diaphoretic medicines. Some time ago I made some experiments, with a scruple of fresh prepared Holt salt, on two ounces of most abominably foetid blood, that had stood two months close corked in a warm room. I put fourteen grains of this salt into it, shook it well, set it down twenty minutes corked, then took it up again and uncorked it, when I found it thinner and perfectly sweet. I put six scruples of this salt to other two ounces of the same blood, to try if it would coagulate it, but it was instantly sweet, and



thinner than before. Fourteen grains of alum dissolved in water, put into two ounces of fresh blood, the mixture presently became a hard, thick, stiff lump. Fifty-two grains of native alum dissolved in water, put to two ounces of the above foetid blood, scarce coagulated it, neither did it take off its foetor. Thirty grains of shop alum dissolved, and put to two ounces of fresh foetid blood, made instantly a thick, stiff, coagulum. Four grains of shop alum, dissolved and put to two ounces of the above foetid blood, produced a common jelly, but lessened not its foetor. Two grains of blue vitriol, dissolved and put to two ounces of foetid blood, turned it hard and stiff, but it retained its full foetor. Six grains of blue vitriol dissolved, and put to two ounces of fresh blood, presently grew stiff and hard. Therefore, 1. If Nevill-Holt water had, or contained alum, how could one hundred twenty grains of its salt turn the foetid blood fluidier than it was before, while fifty grains of alum slightly coagulated the same quantity?

2. It would hence appear, that the antiseptic property of the Nevill-Holt salt lies not in its quantity or acid, but in a peculiar quality of that acid; otherwise fourteen grains of it could

could not take off the fœtor and putrification when fifty-two grains of the other did not.

3. Hence it seems that antiseptic and coagulating powers are very different properties, though perhaps both may arise from the same original cause, but varied by different mixtures and modifications.

4. Hence appears the great difficulty and danger in curing a putrid or putrescent state of the blood, which hitherto has been thought to be chiefly the work of nature, assisted by small aceffant potables in a plentiful quantity, and keeping the body moderately warm, with a free ventilation of fresh air.

5. That that may cure a dissolved state of the blood, which neither prevents nor takes off putrification.

6. If there is no alum in Nevill-Holt, then less fear of vitriol of copper, since two grains of it were equal to fifty grains of alum; and in the former experiment five or six grains were equal to fourteen of the other. We see here also the difference between native and shop alum, which has the alcalis.

7. The horrid urinous smell, sent out from that thick, tough, glutinous matter, when a large quantity of this and Clifton waters are near boiled away, indicates an alcali in the water,



water, as does the fœtor its jelly contracts by standing all winter in an uncleaned-out cistern, and also some few bottles of water turning fœtid.

8. All acid mineral spirits, and inflammatory vegetable spirits, coagulate both extravasated and circulating blood and juices; but common distilled vinegar, juice of lemons, and sweet spirit of nitre, coagulate the former, not the latter blood. Hence see the superior advantage and safety of the latter acids in medicine.

9. From this and former experiments, we see that putrid blood requires five or six times the force of acids to correct it that is necessary in other cases. Yet this large quantity of acid is in less danger of coagulating, which may encourage a more liberal use of them in putrid cases, especially as the blood is oftener disposed to be acrid or bilious.

10. Considering this extraordinary fixed antiseptic property in this water, if it had no other (as it has many) is there another trading, maritime, ingenious nation on the globe, which has been told of, known, and experienced such an antiseptic, antiphlogistic, bracing, antibilious and antiscorbutic treasure and medicine among them, that would neglect or disesteem

it, being so well adapted to a sea-fareing life to diet, air, and variety of climates, chiefly in hot countries and long voyages, as this nation does?

11. Its crystals prove it to be neither alum nor vitriol, being of the same figure with nitrum calcarium, or Scarborough, Epsom, Cheltenham, &c. salts, only are sometimes serrated on the edges.

12. This clear shot-star like substance, subsiding in the cistern in winter, seems acrement peculiar to this water, instead of the ochre in chalybeates, or the white rays and black sludge in the course of sulphur waters.

13. If one dissolves several sorts of natural salts in the same water and vessel, boil the solution to a lee, and set it in a proper place to crystalize; the salts attract not one another promiscuously, and so project crystals of enormous figures, but each species of salt attracts and forms crystals of its own genus only, repelling the other different sorts of salts. But several species of the same genus will readily unite and crystalize, as in Nevill-Holt, Epsom, Cheltenham, Scarborough, Clifton, Sutton, &c. The two last are the most alkaline we have of the neutral salts in England, and the first the most acid, yet they all unite, and project  
the



the same sort of crystals. The first loses all its harsh, acid taste, especially with Clifton water, whose salt tastes smooth, soft, cooling, and oily; and though Holt and Clifton salts seem both of the same sort, yet they agree not so well, for each projects its own crystals. A lee from Wiggleworth water is always thick, opaque, of a dark brown colour, almost like balsam of sulphur. But a lee of Holt water put to this clears it, and, as I am informed from notes before me, the former could never be brought to crystalize, without the addition of some acid. This is the only bituminous water I have seen in England, and, if attended by a St. Christopher Meighan, we should have no want of Bureges water here, which latter is warm, yet the former, though cold, will bear moderate warming with little or no loss of its sulphur, yet is not nauseous. In a lee made of Nevill-Holt salt and alum mixed, each projected their own different crystals, and in the same proportions as the quantity of each put in, therefore both cannot be the same salt; or, if the experiment is made separately in two dishes, let both crystalize, weigh them, then mix and dissolve them in one dish, make a lee, set it to crystalize, and you will have the like different crystals as before. From a lee of  
a solution

a solution of Holt and Clifton salts, they unite and project the same crystals, but the former loses its roughness and acidity.

14. It was remarkable when several scores of gallons of Holt water were evaporated or boiled away over an open fire to a 30th part, and fifteen or sixteen parts of the earth, which it had thrown down in large thin cakes like clear ice, cake after cake, with a constant loud rattling noise in boiling, taken out, washed in rain water and dried, and washing water filtered and put to the lee, and that evaporated till dry, and the sediment taken out and cold, like wax, it melted sooner in a gentle dry warmth, than in hot or boiling water. A lump of it, of several pounds weight, laid thirty-six hours in four several boiling waters, yet a half of it was not dissolved, but taken out and set down at a distance before a very small fire, it melted down to a thick mellaginous substance, like common balsam of sulphur, had a strong sweetish smell, and was yellow like wax. Though the salt from a large quantity of water boiled away by several fillings up, is yellow like *ens veneris*, or cowslip peeps, yet from a few quarts or gallons of water wasted away in a clean vessel over a clear fire, and not filled up  
at



at several times, it is as white as any other pure salt. A strong lee of this sediment or salt, stirred up when hot with bright iron, turns presently of a blackish or dim copper colour; but if it contained copper, its vitriol would be blue. The steam of the evaporating, boiling, or cooling lee, or salt drying on a slow sand-heat, or at a distance before a moderate fire, turns bright steel, brass, or white furniture in the same and adjoining rooms, if the doors are open, like copper; and white metals, black or yellow. It stains all metal furniture in a room, where it stands warm and open some time.

Abundance of experiments prove the acid in this water to be vitriolic. It attracts, dissolves, and unites first with fixed alcalis, chiefly vegetable. It attracts with a furious fermentation, and with absorbent earths, as we saw before. It is a speedy powerful solvent of iron. This, like all other salts, saturated with alcalis or absorbent earths, loses its acid taste and corrosive quality, becomes saline, bitter, inoffensive and safe. Only the vitriolic acid, joined to its peculiar earth, gives that rough austere styptic salt called alum. This acid, with much iron, yields a mild sweetish astringent. This fixed  
acid,

acid, with iron and a little gall, on standing, gives a grass green colour as in this water. It is the iron and this acid that give the sweet steam and mellaginous smell. It is this acid, united to a mineral alkali, that projects hexagonal crystals like nitre. This acid, with vegetable alcalis, makes a tartar vitriolated, crystals, and cream of tartar. Even this, which is volatile in chalybeate and other waters, becomes fixed here by its strong attachment to, and union with a phlogiston. This union is inseparable without fire. The quantity and inseparability of this salt from its earth, is known from the quantity of water necessary to dissolve each of them. Even in a small quantity it requires seven or eight times its quantity of water to dissolve it. Large quantities require much more and longer time, as we saw above. Alum requires fifteen or sixteen times its quantity of water, tartar twenty-six or twenty-eight times its quantity of water. The vitriolic acid with quicklime, selenites, and chalk, gives firm and lasting crystals.

The several impregnating principles in this water, when united, seem wisely and justly proportioned to answer the intended end as they come to us; so that such as have stomachs



machs to drink it, and where the case and strength of the patient will allow it, it should be drank with as little alteration or separation as may be. For it has been observed, that a too strict and nice analization of its parts have been found injurious both to patients and medicine, by decomposing its principles. Even its earth has given great relief in disorders of the bowels and urinary passages. Not that the whole complex fixed parts of earth and salts, when separated from the salts, should always be given together. One single filtration thro' a thin, spongy paper cap, is sufficient to transmit the soluble and useful parts, and separate the gross earth. Crytallization is found detrimental to the medicine, and only where the water cannot be got, or is too bulky for carriage, the salts may be used. Where the water is disagreeable, it is shewn before how to correct it. The salts, when judged proper, may be given dissolved in any liquor; from six grains to twenty-four, two or three times a day, and in bilious, acrid diarrhæas, dysenteries, or bloody urine, the selenites and earth given in powder have been found very useful. The water itself, judiciously, seasonably, and properly used, is capable of various forms of exhibition, as it corresponds to several indications.

tions. But the custom of giving purging salts with it thwarts its whole design as an alterative, in which view it should always be given.

Thus it seems evident, that this water contains an acid, which neither that of copper, sea salt, nitre, nor muriatic do. If it had not an acid, it could not catch hold of, and unite with the alkaline, fixed, or volatile or, and let go their earth to be separated, curdle, and fall down in a white slime while wet, and powder, when dried, which ferments with acids. Or from whence should it have such a quantity of talc, selenites, &c.? Without an acid there could be neither talc nor selenites; for the acid wrests the earth from the muriatic salt, and precipitates it, and uniting with it forms the selenites. This acid and calcarious earth form the neutral salt. And a fixed alkali, uniting with acid, gives a muriatic salt, and precipitates the earth. This water has therefore both a semivolatile and fixed acid, and an inflammable principle, by which it has a strong attraction and firm union. Here then are the acknowledged parents of sulphur, of which there are various kinds in the mineral kingdom, all readily uniting with alkalis, and so become soluble in water. There



is room to think it contains sulphur from the colour, friability and inflammability of the filtering caps, or coffins, burning and twinkling with a blue flame after the white flame of the paper ; and its furious burning with great vehemence in the crucible in a glass-furnace, with a blue flame, and suffocating smell of sulphur.

The acid of this water is vitriolic, 1. Because infusion of fresh armerius, spotted flowers and husks, turns it pink and purplish, which it will not with gall, having so little iron in it.

2. From the solution of its warm water turning purple or black, when it has stood long.

3. From its turning bright or polished iron black, or a dark purple ; brass and white metals, black, or like copper.

4. The vitriolic acid, with chalk, lime, or calcarious earth, preserves a dry, solid form in the selenite talcsand. This acid is most strongly attached to and united with the phlogiston.

5. It catches more eagerly, and holds faster any alkaline salts, than either the acid of sea salt or nitre.

6. Though of all others the vitriolic acid is the strongest and most powerful, yet it unites  
with

with the nitrous and muriatic acid, and alkaline base of fixed salts; notwithstanding a little of the phlogiston and vitriolic acid, with absorbent earths, gives a salt, the crystals of which retain their figure and dryness in the air, like alum. This shews that alum has its acid from vitriol. We meet with the like firmness in talc and selenites.

7. Vitriol and sulphur proceed from the same matrix, viz. the pyrites; and green vitriol is composed of iron and sulphur. Iron is the basis, and spirit of sulphur the solvent; hence spirit of sulphur separated from its base, iron, makes strong oil of vitriol, instead of which spirit or oil of sulphur is now often used. But the much fixed alkali in this water, with the powerful vitriolic acid, gives it this acid bitter, but not sweet tasted.

8. As was said above, the crystals of Holt salt are always hexagonal, like those of nitre, but those of alum vitrogonal.

Some waters are said to contain a volatile alkaline spirit, though rarely perceived by either smell or taste, but to be discovered by putting acids to them, and by its turning syrup of violets green, and causing a milky white precipitation in a solution of corrosive sublimate. Some loamy earths have this salt. Several bodies that con-



tain sea salt have somewhat of it in them, and several other materials in the earth contain it, but not in a concrete form; for being volatile it always flies off till it meets with acids. Then it attracts, and both uniting form an ammoniacal salt, made of a volatile, urinous alkali, and the acid of sea salt. This is the true original of natural sal ammoniac. Several waters are said to contain both a volatile and fixed alkali demonstrable from this; true natron (which is universally acknowledged to be an alkaline salt) and sal ammoniac rubbed in a warm mortar, with a hot pestle, emitted a more volatile spirit than spirit of sal ammoniac and quick lime. Sal tartar and sal ammoniac rubbed together in a warm mortar and pestle, sent out a faint urinous smell. Sutton bog and Wigglesworth salts rubbed with sal ammoniac sent out a smell of vapid spirits of hartshorn. Clifton salt thus rubbed in a hot mortar became a strong volatile sal ammoniac; natron, sal tartar, Clifton, Sutton bog salts, all dry or in solution, fermented strongly with the juice of lemons, vinegar, spirit and oil of vitriol, spirits of sulphur and salt, strong spirit of nitre, but more faintly with oil of vitriol and lemon juice. Clifton fermented more violently with mineral acids, and more faintly with vegetable. A solution of silver dropt into  
a so-

a solution of natron in warm water, a violent fermentation for several minutes ensued. It bubbled furiously from top to bottom, and sparkled very high, the liquor being opaque, white as milk, then curdled, and let fall a white thick, light sediment. Solution of silver, put to the like solution of Sutton salt, fermented as much and violently, threw up a great white thick foam, which prevented its sparkling, was white, thick, and let fall a large white sediment, yet no marine salt in it. Solution of silver in solution of Clifton salt, was a whitish pearl colour. Solution of corrosive sublimate in warm water with natron and sal tartar were a brownish red colour like sinoper, thick, opaque, curdled, and let fall a red mucilage on the sides of the glass. Sutton bog salt with sublimate gave a whitish pearl colour. Clifton a reddish brown which soon faded, curdled a little, and turned of a light brown, with a greenish yellow cast at top. Urine turned all the solutions with sublimate whitish, like a clay water. But solution of sal tartar turned all the solutions of sublimate red, but they all soon became thick and whitish, till urine curdled the whole. All the solutions of sublimate turned the solutions of natron, sal-tartar, and pot-ashes, Sutton bog salts, and all the other lixivial salts, a reddish

P 3

brown,



brown. So the solutions of Clifton, salt of hartshorn, and all the volatile alcalis in warm water, turned instantly white and thick like milk, curdled, and let fall a white sediment. Fresh warm high coloured urine put to solutions of natron, sal tartar, pot-ashes, Clifton, Wiggleworth, Sutton, and Kingham bog salts, smelled all like weak spirit of hartshorn. An infusion of red roses, put to a solution of these salts and spirits, volatile and fixed natron, turned a deep green, the rest to a beautiful yellowish green and let fall a yellowish-coloured sediment. To other fresh solutions of these salts in different glass cups were put a few drops of a solution of ultra-marine blue in gum-water. In natron it lost its colour and was clear; tartar, pot-ashes, and Holt, were a notable sky blue, but faded in two hours. Tartar curdled and let fall a very large bluish sediment; pot-ashes and Sutton salts a small one; Clifton a pale, bluish, white one, which with the solution of Nevill-Holt salt, being equally divided among the rest, dissipated all their sediments, and restored their fine, light, transparent blue spirit of vitriol; a clear proof both of an acid and a vitriolic acid. Solutions of these salts made in hot water, and a solution of verdigrease in boiling water put to them, natron, tartar, pot-ashes, Sutton salt,

salt, were all a clear blue, but soon curdled, and let fall a blue sediment, and a crystal liquor above ; but Clifton was a cowslip yellow, or yellowish green, with a little bluish cast. By these tried and several times proved experiments, we find that there are not only mineral waters that contain an acid, some an alcali, but such as contain both. Having found this water has an acid, what it is, and whence it is, and though it be vitriolic, yet from the experimental discourses it is plainly a peculiar one, and that the speciality and peculiarity of the water resides in this acid only, and by no means in alum, fixed vitriol, or copper, of all which it is destitute. Having thus come experimentally, I shall now presume to propose a probable method, I which have not yet tried, to find the characteristic differences of the salts in mineral waters, what their contained acid or alcali is, and if the flying off of either can be prevented,

1<sup>st</sup>. Try with new milk first, then with blue milk, butter-milk, or both. If an acid prevails, it improves their whiteness ; if an alcali, it verges to a yellowish brown, ochry, or red colour. Both acid and alcali curdle hot milk less or more, as the water contains less or more perceptible salt.



2. The curd from acid is not only whiter, but stiffer, harder, and tougher, the whey clearer, finer, and thinner. That from alkali is softer and more spongy, not so stiff, white, or hard as the other; the whey less pure, more white and milky.

3. Try whether any, or what proportion of neutral salts will coagulate milk.

4. Whether any or what quantity of volatile alkaline salts will coagulate milk, and if, when they or spirits are put into hot or cold milk, it entangles their volatile parts, either by its acid or consistence or both, and checks their flying off.

5. If milk prevents not dissipation, will a solution of gums in water or milk do it?

6. What are the several coagulating powers of fixed and volatile alkalis, or of neutral salts.

7. Try to find what salts or spirits add to the gravity or levity, tenuity or visciduity, of blood or other juices. Try any quantity of rain or distilled water with an exact weight of common or other salts dissolved in them warm, let them stand till cold, then try them both warm and cold with an exact hydrometer. Try also the like quantity of blood, bile, milk, urine, &c. with a certain weight of salts dissolved, having

having first tried the cold fluid alone. Thus also may be tried the several viscidities and consistencies of those juices by comparing them with solutions of gums or mucilages.

To discover any thing volatile in mineral waters, try first what quantity of oil of vitriol coagulates any exact given quantity of warm new, blue, or butter milk, kept so many hours in the same temperature of air, and same place; then to the like quantity of the same milk warmed, put any exact weight of fixed or volatile alkali or absorbents, stir and mix them well; try if the second does imperceptibly fly off from and through the milk, then add thin diluted oil of vitriol, find what brings it to a neutral state, and hinders the flying off of the volatile part, and coagulates it.

To discover the proportion or quantity of acid in juices or water from the greater or lesser quantity of acid necessary for neutralization and preventing coagulation; and as we saw an alkali may be thus discovered in mineral waters or animal juices, so may an acid in water or well diluted juices, by adding absorbents, as calcined oyster shells, crabs claws, chalk, quick-lime, salt, or oil of tartar, and natron, in the same manner.

From



From a much less quantity of white or blue vitriol coagulating animal juices, we see how much more iron green vitriol contains in proportion to its acid, than which, most from zinck, with a scantling of iron ; and the large quantity of copper in blue vitriol ; and the great alcali in iron, which speedily and powerfully attracts the acid in copper, and leaves it naked on the iron bars ; yet the copper so left retains its deleterious corrosive acid. The alcali of iron is manifest, its filings or rust being found to be great septics, and binding up its vitriolic acid, so as it cannot coagulate our fluids till it is separated from the iron or irony matter ; yet how soon may the ferruginous be separated from the water and its other earths, and may be transported many miles without loss or evanishing, and as quickly be restored and made invisible again, but not volatile ? With as much ease may fine calcarious earth be separated out of water, from iron and other earths ; and with the same ease may selenitical earth be separated in water from its acid, calcarious, and insoluble earths. Hereby we see the reason why stale urine and other very putrid juices require five or six times the quantity of Nevill-Holt salt to sweeten them, that fresh blood does to prevent putrification. Hereby we  
see

see the reason why there is a greater quantity of urinous salt both in fresh and stale urine, than in blood.

2. That serum attracts five times more salt than the blood.

3. This assists in discovering the quantity of urinous salt in a sick person's blood;

1. From the time it requires to putrify,

2. The colour and smell of the new-made urine. 3. The quantity of antiseptic salt necessary to restore it when putrid.

4. Hereby we are helped to know in what cases Nevill-Holt water is proper or improper before it is drank.

5. From the greater or lesser turbid state or precipitation caused in fresh urine, by this water or its salts.

Hence, 1. It appears erroneous to say, that neither acid nor alkali can be produced from fresh animal juices.

2. Not only where acid or alkali prevails, but in what proportion or degree either of them does so.

3. This being known, to find the method of cure is easy.

Hereby it appears, that some mineral waters contain not only one, but sometimes two acids

of



of the same kind; one more fixed, another lighter or semi-volatile. Both are shewn to be in Nevill-Holt water, and both vitriolic. It has also been shewn, in a discourse on coagulation, how both may be discovered, and how we may easily come to the knowledge of the certain quantity of acids impregnating a water, whether it is volatile or fixed, or how much of either. And here is shewn the several losses by the different ways of evaporation or decoction in various vessels, and the great loss this water sustains by all of them. Some of these observations being new, and others of them set in a clearer light than before, and having dispatched more than was proposed, I might be excused in dismissing the subject, were there not still wanting several remarks relating to this water in particular, and to the subject of mineral waters in general.

That this water is remarkably cooling, is manifest from a mixture of its salt and snow lowering the mercury in Fahrenheit's thermometer, several degrees lower than the like mixture of snow and nitre. And it is observable in practice, that a whey made with this water, in ardent fevers, quenches thirst, abates heat, checks a too rapid circulation of the blood, lowers the pulse, clears and cleanses the mouth, throat

throat and passages from blackness, dryness, nastiness and shriveling up, sooner than the nitrous or any other drinks ; and that a solution of its salt, in a moderate quantity, cools and necessarily throws a lentor on the too hot rapid blood. In hæmorrhages this water has often had surprising effects, by bracing the vessel, correcting an immoderate stimulus or acrimony of the blood or its thinness ; by abating its rapid career, and too strong impetus on any one part ; by relieving a plethora (after necessary bleeding) by urine, stool, sweat, and taking off the accension and rarification of the blood more effectually than either nitrous or astringent medicines do. Wonderful has been its success in preventing abortions, whether from a plethora, too rich and plentiful living, habitual costiveness, weakness, any abrasion, laxness, or slipperiness of the uterus, or its vessels ; or too great a redundance of its glandular juices, when the water is regularly drank, in small doses of three half pints a day, at several times, from the end of the second or middle of the third month to the end of the seventh, with sometimes a little red port-wine. Several have used it who had suffered sundry abortions, especially one lady who had miscarried ten or eleven times. Also some who had had either real or threatened



ened miscarriages, attended with a hectic. This water has never failed in relieving any such patients, who lived regularly in body and mind. In scrophulous ulcers without carious bones, in sanguine constitutions, it has had very good effects, even in emaciated bodies, scrophulous ulcers and consumptions. It has cured several of dry asthmas, where there was no adhesion of the lungs to the pleura. It has cured several of hectic fevers, where there was little or no expectoration, nor load of humours on the lungs. In hot scurvies, or scorbutic habits, especially in long voyages and hot climates, its use would wonderfully supersede that of all other medicines, acid fruits excepted. But at land it will succede better if drank twice a-day, with a spoonful or two of wild parsnip juice put to it. In rheumatisms, attended with an inflammatory fever, great heat, thirst, pains, and other inflammatory symptoms, after moderate bleeding, nothing succeeds like its whey, drank tepid in bed. A bottle of this water, drank every night for eight or ten successively, sweats most powerfully. If it purges, do as directed above. In the stone and gravel, though it dissolves not a concrete stone, yet where there is no lodgment of a great stone or stones, which forbids the  
 use

use of this water and other diuretic stimulants, it is of great service. Also when used along with the tepid bath, emollient glisters, anodynes and proper internals, whereby pain, irritation and stoppage of urine is removed. For in such cases this water has not only brought away the obstructing matter, whether consisting of sand, small stones, or fabulous concretions, but by drinking it one or two whole summer seasons, at the rate of three half pints a-day, and living regularly, all future lapses have been prevented, and cured the stone's breeding indisposition in the blood, which had before caused great torment, and exposed the patient to imminent danger. Besides, it is scarce possible so effectually to prevent harm either from Mrs. Stephens's medicine, or the rotulæ sublinguales, used for abronchocele, or a profuse imprudent use of mercurials, as by the use of this water, or a proper use of Bath or other hot mineral waters; for it not only prevents mischief from all these, but at the same time it assists in carrying on the same designs with them.

That it is a sovereign antiscorbutic, is evident, not only from its preventing and removing the most odious fœtor of extravasated animal juices, and restoring their natural smell without coagulation ;



tion ; but from its often experienced like effects in putrid, petechial flow fevers, where drinking the water or its whey removes the offensive smell or breath, saliva, sweat, urine, &c. and even red livid brown spots themselves. The like success it has in bilious disorders, cholics, loosenesses, and in most disorders arising from alkaline or putrid humours. In scrophulous inflammations of the eyes drinking this water has often had amazing success, when more likely and pompous courses have failed. In habitual morning heavings, vomitings, and want of appetite, from intemperance, frequent debauches and surfeits; which have relaxed the stomach, loaded it with phlegm or sharp humours ; this water is the most proper remedy where it will sit upon the stomach. To insure this hints have been given above. What effects it may have in the gout, is yet uncertain, as it has been tried only in two dangerous cases; one of them that of a young gentleman scarce thirty years of age, to whom this disorder was hereditary, and of the worst kind. He had but an indifferent constitution, and had suffered much by several slighter attacks very early. In this fit it had left the extreme parts, and was fallen with its whole force and fury on the stomach, with a  
raging

raging fever and inexpressible pain, unquenchable thirst, incessant reachings, and vomitings; a throbbing quick pulse, scanty high coloured urine, and insupportable agony. The seemingly best internal and external methods had been taken with him in vain. By them the symptoms were only exasperated, and immediate death expected by himself and his friends. As his scorching heat and parching thirst were not the smallest part of his misery, the nurse was ordered to indulge him with half a pint of this water, warmed, at several times, rather as a gargarism than drink. But so raging was his thirst, that in one hour he, by threats and flattery, extorted from her and drank two ale-quarts of it. His vomiting was presently stayed, his heat, thirst, fever, pain, and agony, much abated. This was immediately followed by five large quick, most foetid stools, whereby all his severe symptoms were mitigated and relieved at once, and by a few days drinking he got quite well, only continued very weak for some time.

The other case was very different. A Clergyman between sixty and seventy years of age, a free liver in Northamptonshire, who quickly after a recovery from a gouty disorder caught cold. By this his distemper returned and fell

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at once on his bowels with great sickness, violent pain, intolerable thirst, insupportable faintness and weakness. He had also above thirty large atrabilious stools in one night, and next day his excrements were mixed with pure blood; and his pulse so weak and low as to be scarce perceptible. The most rational and probable methods were used for his relief, without success. His weakness encreasing, and his speech failing, so as his voice could not be heard, and having neither been got out of bed nor could use a bed-pan for many hours, he had a pint of this water given him, tepid, at two or three times, to be repeated at small intervals, with a spoonful or two of burnt red port wine to be given between each two very small glasses of the water. All his symptoms soon vanished, even his profuse stools changed to fewer, more moderate, and free from blood. His pulse soon got stronger, his pain and thirst left him; only his weakness and black stools continuing some days. But a few doses of roasted rhubarb, and the dried sediment of epichuan wine, carried off the black, but now painless stools. He soon recovered health and strength.

Another instance of its efficacy is the case of Mr. J—n W——k, of Doncaster, whom  
intempe-

intemperance and debauchery had brought into a hectic and atrophy, with continual vomitings, so as neither a bit of food nor a drop of liquor of any sort would stay a minute on his stomach. This want of sustenance and hectic wasted him to a skeleton. He consulted the best physicians both in city and country, and was sent to all the noted mineral spaws, both cold and hot, in the north and south, from which he received not the least benefit. At last he was brought from London to die at home, nothing else being expected. He had been long confined to bed or to a horse-litter. His thirst was great after his return home. In a few days an aged gentlewoman went to see him, and insisted on his drinking half a pint of this water. He, though unwillingly, consented, drank it, layed down, and fell asleep, which he had not done with composure for many months before. On wakeing, she gave him another cup of it. He had another short sweet sleep, waked, and eat some nourishing food. He continued to drink the water, a bottle a-day, vomited no more, got well and strong.

A gentlewoman living at some distance, who had by times been often in danger from a bilious cholic, taken many medicines, and been at



many spaws, without reaping any advantage, hearing of this cure, sent for half a gross of the water, drank it, and never felt a throb of pain after.

The case of an old, decrepid, gouty gentleman (a member of the lower house) his eldest son Mr. S——n, is remarkable.

He laboured some years under a violent pain of his stomach, and habitual vomiting up of all kinds of food and drink, till he was reduced to mere skin and bones. He had the advice of the best physicians in London, Bath and Bristol, to no purpose. Being an acquaintance of the late Mr. Nevill, he invited him down to his house to drink this water. He was brought down, stayed five or six weeks, drank the water all the while regularly, got well, strong, and returned home to the South sea.

There have been many more instances of this kind; but, as was said before, chiefly from the bilious, acrid, or athritic humours, and in hot, dry seasons, or from too heating, drying, acrid foods, sauces, or made-dishes.

In this water is shewn, that beside the volatile acid in chalybeates, some mineral waters have an acid either semi-volatile or fixed, or both, as we see in this. Therefore the name  
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of acidulæ has been unjustly, too suddenly, and universally exploded. That was the principal design of this treatise on acid waters. And further to shew, that Nevill-Holt water contains neither copper, alum, nor common fixed vitriol; that its whole virtue and speciality depends only on its peculiar acid firmly attached to salt mainly, and which may be for most part separated from its earth: that this acid and its *minera ferri* are two different things: that as it is not the acid of copper nor alum, so not of nitre, muriatic, sea salt, blue nor white vitriol, though it is most allied to the vitriolic acid, yet in some instances different from it, and allied to the vegetable acid, as that of wine, tar, &c. all of them derived from the vitriolic, and that from the universal acid. And through the whole as they fell in my way, chiefly near the latter end, to point out the constitutions and diseases that thirty-six years experiments and observations have found it most successful in.

I shall subjoin several cases, where it is unadvisable; for I do not recommend it as an universal remedy. I have only advised it for most part as an alterative to be drank at several times in the day, to the quantity of five or six ounces at a time, and the largest dose at going



to bed, so, as according to different ages, from half a pint to a quart be drank daily, indulging moderately with a little red port-wine, where circumstances will admit of it. I have also shewn, that few medicines, especially purgatives (after the first passages are open and cleared) are required; and I have shewn how easily its disagreeableness to some young, tender, delicate tastes and stomachs, may be remedied: how diarrhœas, from its necessary and habitual use, may be prevented or relieved; and how the water, being carefully bottled and sealed, will keep good, either at home, sent abroad, or in long voyages, during many years.

Diseases or cases in which its use is improper are, where the blood is thick, earthy and grumous, and the solids small, firm, strong and closely connected; where natural and necessary evacuations are suppressed, or much diminished; or where there are manifest signs of a prevailant acid in the stomach and first passages to it. Neither is it proper in diseases of the breast, when life and recovery depend on plentiful and easy expectoration; nor in bituitous or phlegmatic constitutions; nor in Boerhaave's spontaneous glue; nor in cachetic, cold, moist, hydropic habits; nor in a colliquative looseness,

ness, often the last symptom in consumptions ; or where there are large stones in the bladder or kidneys.

It is plain from the whole analysis, that this water alone, so far as yet known, contains a native vitriolated tartar from its vitriolic acid and vegetable alcali; it has also much selenitical earth, and a very little iron besides some bituminous matter.

N. B. *This water may, at all seasons, be had fresh from Owen's mineral water warehouse in Fleet-street, hard by Temple-bar.*



*Of solvents of the stone in the kidneys and bladder.*

**A** SOLVENT of the calculus in the kidneys and bladder, has been long wanted and eagerly sought after. The anti-ents groundlessly ascribed this power to things which, upon trial, were found not only useless, but ridiculous ; as ashes of calcined hare-skins, &c. Nor have some moderns come far short of them, as Lobb's dry crusts of bread eaten fasting in the morning ; or camomile juice injected into the bladder. Mrs.



Stevens's medicine (so despised and ridiculed by some who have not yet discovered a better) has employed some eminent heads and hands, to find out a more efficacious solvent; but I am afraid with little success. The late great improvements in chemistry raised the expectations of many; but whatever boastings were made, most of their medicines were of too irritating, contracting, corrosive, or caustic a nature, for the delicate, exquisitely sensible coats or membranes of the bladder, or indeed any part of the living body, to be applied with safety. Few experiments have extended farther than to things often hurtful, or to the improvements of Mrs. Stevens's remedy, or in the gratification of some ill-grounded hypothesis. Others, from some prejudices, rail against all attempts of this sort, and indeed with some foundation, as appears from the many disappointments that have attended the most ingenious elaborated endeavours used for discovering a sure and safe remedy. But this ought not totally to discourage farther attempts in the pursuit. Some lucky hit or accident may some time or other produce what learning or philosophy could not; and at worst it can be but time lost in quest of a lawful and useful medicine. Beside they may perhaps  
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let some further light either into this or other diseases, or to the insensible softening, wasting, and mouldering some generating stones; or prevent their breeding in bodies liable to them, or mitigate the severity or some symptom of the disease. Such discoveries would not be of contemptible service, nor would it be time lost in search of them. But to facilitate the work some things should be inquired into. First, what stones are easily, difficultly, or not at all soluble, and in what menstrua. Secondly, whether the solvents be either harmless in themselves, or can be rendered so. Thirdly, to find out the marks of those differences, or each of them. Fourthly, to know to what stones, putrifactions, or concrete bodies, the calculus is most allied or similar.

We procured various calculi of different shapes, sizes, and consistences. One of them consisted of several strata, and a rough, knobby substance. Its outward stratum was brown, hard and uneven, the thickness of half a crown. The second coat was a dark pearl colour and softer. The third coat was very hard, of an iron-colour, thicker than both the two others, and diced like lead ore. The fourth was whiter and softer than the second, containing a soft nucleus, or kernel, large as a walnut, whitish,



whitish, and rubbed to a small dry sand between the fingers. The hard scales of this stone were equally parted, and put into fifteen phials. Into the next thirteen and the thirty-second, was put a white, soft, tephaceous calculus. Three phials were set fourteen hours in an oven, from one hundred to two hundred degrees of heat, then removed for fourteen days, viz. from July 14th to 29th; the calculi were exactly weighed, both when put in and taken out of the phials; No. 5, 13, 15 and 18, fermented strongly, especially when first mixed; they were hot, smoaked and muddy, then curdled and broke; when taken out of the oven they were clear, of a light greenish yellow colour; the calculus was covered with long beautiful spicula, or hair of fine saline efflorescences, like pine burr prickles. Ten days after, the liquor was muddy at bottom; on moving it these long spicula appeared, and the calculus was dissolved. A third stone was large, brown and hard, besides several other different stones. August 19th the thirty-second of the first vials was set in a warm oven ten hours, from ninety to a hundred and twenty degrees of heat, No. 10, 12, 15, 18, were all dissolved in the first thirty-eight hours.

1. Calculi

- 1 Calculi gr. 17. wild chamomile juice }  
dr. 4.
- 2 Ditto gr. 16. oyfter-shell, lime water }  
dr. 4.
- 3 Ditto gr. 10. 1st lime water dr. 4.
- 4 Ditto gr. 10. 2d lime water dr. 4.
- 5 Ditto gr. 11. oyfter shell lime water,  
wild chamomile juice dr. 4.
- 6 Ditto gr. 12. 2d lime water and cha-  
mom. juice aa dr. 3.
- 7 Ditto gr. 9. mineral water falt gr. 9.  
warm water dr. 3.
- 8 Ditto gr. 9. mineral water falt gr. 9.  
cham. juice dr. 3.
- 9 Ditto gr. 13. mineral water falt gr. 9.  
oyfter shell lime water dr. 3.
- 10 Ditto gr. 14. mineral water falt gr. 9.  
1st lime water dr. 3,
- 11 Ditto gr. 9. fal tart. gr. 9. warm wa-  
ter dr. 4.
- 12 Ditto gr. 9. fal tar. gr. 9. chamom.  
juice dr. 4.
- 13 Ditto gr. 14. spt. nit. fort. dr. 1.
- 14 Ditto gr. 4. spt. falis half dr.
- 15 Ditto gr. 11. spt. nitr. fort. scr. 2.  
cham. juice dr. 3.
- 16 Ditto gr. 9. spt. nitr. fort. dr. 1.
- 17 Ditto gr. 9. spt. fal. dr. 1.
- 18 Ditto gr. 13. sp. nitr. fort. dr. 1. } all dissolved and  
cham. juice dr. 5. } fal efflorescence.
- 19 Ditto gr. 10. fal. tart. gr. 10. cham.  
juice dr. 4.
- 20 Ditto gr. 10. cham. juice.
- 21 Ditto gr. 10. oyfter shell lime water  
dr. 4.
- 22 Ditto gr. 13. mineral water falt gr.  
10. old lime water dr. 6.
- 23 Ditto gr. 13. 1st lime water dr. 4.
- 24 Ditto gr. 9. mineral water falt gr. 9.  
cham. juice dr. 6.
- 25 Ditto gr. 9. ditto gr. 9. 1st lime wa-  
ter and cham. juice aa dr. 4.
- 26 Ditto gr. 10. spt. nitr. fort. dr. 2. } clear and dissolved  
cham. juice dr. 5. } from 15 to 25 were  
soft calculi.

27 Ditto



- 27 Ditto gr. 16. lemon juice dr. 3.  
 28 Ditto gr. 16. distilled vinegar dr. 4.  
 29 Crabs eyes powdered scr. 1. lemon juice dr. 4. } all clear and sweet.  
 30 Oyster shells scr. 1. lemon juice dr. 4.  
 31 Red coral scr. 1. distilled vinegar dr. 5. }  
 32 Calculi gr. 17. ol. vitriol dr. 2. } fallen to sand.  
 33 Ditto gr. 16. spt. nitr. fort. dr. 2. } softened, with a white  
 34 Ditto gr. 6. spt. nitr. fort. dr. 1. } surface.  
 35 Ditto gr. 6. spt. sulphur dr. 1. } dissolved.  
 36 Ditto gr. 6. spt. sal dr. 1. } softened to a gritty  
 37 Ditto gr. 8. spt. vitriol dr. 1 1-half } sludge.  
 38 Ditto gr. 7. ol. vitriol dr. 1 1-half } dissolved and sea salt  
 39 Ditto gr. 9. aq. fort. dr. 1 1-half } crystalized.  
 40, 41, 42, Ditto gr. 9. each, lemon juice, } dissolved.  
 common and distilled vinegar, each } hard and blackish.  
 dr. 3. } dissolved.  
 Stalactites gr. 9. in each phial, with }  
 the following ingredients. } no effect at all.  
 43 Spt. nitr. fort. dr. 1. } dissolved to a white  
 44 Spt. sulph. dr. 1 1-half. } calx.  
 45 Spt. falis dr. 1. }  
 46 Ol. vitriol dr. 1. } clear and dissolved.  
 47 Spt. vitriol dr. 1. } part dissolved and part  
 48 Aq. fort. dr. 1. } hard calx.  
 49 Lemon juice dr. 2. } dissolved to a calx.  
 50 Distilled vinegar dr. 2. }  
 51 Common vinegar dr. 2. } both dissolved.  
 Calcined oyster shells gr. 8. in each  
 phial with the following  
 52 Spt. nitr. fort. dr. 1. cham. juice dr. 2. }  
 53 Spt. sulph. dr. 2. juice of celery dr. 3. } all dissolved.  
 54 Spt. falis dr. 2. }  
 55 Ol. vitriol dr. 1. }  
 56 Spt. vitriol dr. 2. cham. juice dr. 4. }  
 57 Aq. fort. dr. 1 1-half }  
 58 Lemon juice dr. 3. } all dissolved.  
 59 Distilled vinegar }  
 60 Common vinegar }

- 61 A fine grained hard pebble was not affected in the least, either by spirits of nitre, salt or sulphur, oil of vitriol, aq. fortis, lemon juice, or either vinegars.
- 65 ——— gr. 7. spt. vitriol dr. 1. dissolved.
- 70 Seven grains of fluors, or English diamond, in each phial, with spt. nitr. fort. spt. sulph. spt. sal. spt. vitriol, ol. vitriol, lemon juice and both vinegars, was not at all affected.
- 75 Fluors gr. 7. aq. fort. dr. 1. } dissolved to small, light fungus.
- 78 Ditto gr. 8. wine vinegar dr. 2. } dissolved.
- Pyrates gr. 8. in each phial with spt. nitr. fort. spt. sal. ol. vitriol dr. 2. } dissolved three grains.  
affected it, but useless.
- 82 Ol. sulph. spt. vitriol, aq. fort. ol. vitriol, lemon juice, both vinegars, all dissolved it. } dissolved to a white calx, much wasted August 27.
- 88 Gr. 7. of a hard, gritty pebble, was not affected by spt. nitre or spt. sal.
- 90 Gr. 4. of a soft sandy pebble, ol. vitriol dissolved it; but neither aq. fort. or lemon juice did. } stone softened, liquor black.
- 93 Gr. 8. of true flint was not affected by either spt. nitr. fort. spt. sal. ol. vitriol, aq. fort. lemon juice or vinegars.
- 101 Gr. 7. of matlock white petrifications, neither spt. sal. aq. fort. or vinegars affected. But strong spt. of nitr. or sulph. reduced it to a white calx; ol. vitriol to a white, soft, granulating mucilage; lemon juice dissolved it.
- 109 Gr. 8. white spar was not affected by aq. fort. But spts. of nitr. sulph. and salt and ol. vitriol reduced it to a calx. Lemon juice and vinegar quite dissolved it.
- 117 Lemon juice only dissolved water spar; but neither vinegars, nor spt. sal.



- 121 Gr. 7. chalk in each phial, lemon juice, both vinegars and spt. fal. dissolved it.
- 125 Gr. 10. calculi warm water dr. 6. stood a month unaltered.
- 126 Spt. fal. gr. 40. dissolved 7 grains.
- 127 Arsesmart tea 1 oz. spt. nitr. dr. 1. } both dissolved in a  
ol. sulph. dr. 2. } week.
- 128 Mullein tea oz. 1. aq. fort. dr. 1. }
- 129 Althæa root decoct. oz. 1. spt. nitr. } lost 3 grains:  
dr. 1. }
- 130 Arsesmart tea oz. 1. ol. sulph. gr. 40. } both dissolved.
- 131 Wild cham. tea oz. 1. aq. fort. dr. 1. }
- 132 Althæa root decoct. oz. 1. aq. fort. } dissolved, lost 7 grains:  
dr. 1. }
- 133 \_\_\_\_\_ aq. fort. }
- dr. 1. }
- 134 \_\_\_\_\_ aq. vitriol. } lost 6 grains:  
dr. 1. }
- 135 \_\_\_\_\_ ol. sulph. } lost 3 grains:  
dr. 1. }
- 136 Arsesmart juice oz. 1. spt. fal. dr. 1.
- 137 Mullein tea oz. 1. spt. fal. dr. 1.
- 138 Arsesmart tea oz. 1. ol. vitriol dr. 1. } dissolved to a white  
mucilage.
- 139 Mullein tea oz. 1. ol. vitriol dr. 1. } lost 3 grains, the rest  
very soft.
- 140 Wild cham. tea oz. 1. spt. fal. dr. 1. softened to a sand.
- 141 \_\_\_\_\_ ol. vitriol dr. 1. soft sand.
- 142 \_\_\_\_\_ spt. sulph. dr. 1. grains 4 soft, 6 hard.
- 143 Wild mallow root and tea oz. 1. } grains 7 dissolved, 3  
spt. fal. oz. 1. } hard.
- 144 Ditto spt. fal. dr. 1. } both dissolved to a  
145 Ditto aq. fort. dr. 1. } sludge.
- 146 Pease water oz. 1. aq. fort. dr. 1. }
- 147 Parsley juice oz. 1. }
- 148 Garden sorrel tea oz. 1. spt. fal. } 3 grains dissolved, and  
dr. 1. } 7 softened.
- 149 Hollyoak flower tea oz. 1. spt. fal. }
- dr. 1. }
- 150 Ditto alone oz. 1. }
- 151 Gr. 12. hard calculi in each phial, } a white, soft jelly.  
cham. tea oz. 1. spt. nitr. dr. 2. }
- 152 Ditto spt. fal. dr. 2. } dissolved, and crystals  
of sea salt.

- 153 Ditto cham. juice oz. 1. spt. fal. } 8 grains of each dissolved not after 11 days.
- 154 Ditto ditto spt. nitr. fort. dr. 1. }
- 155 Ditto spt. nitr. dr. 1. warm water } dissolved to a white jelly.
- 156 Ditto spt. nitr. only dr. 1. } all dissolved.
- 157 Ditto celery juice oz. 1. } dissolved in 11 days.
- 158 Ditto spt. nitr. fort. dr. 2. } dissolved to a fludge.
- 159 Soft calculus gr. 14. leek juice dr. 6. }
- 160 Ditto gr. 10. cham. and leek juice aa dr. 4. }
- 161 Ditto cham. and celery juice aa dr. 4. } no effect.
- 162 Ditto celery and leek juice aa dr. 4. }
- 163 Ditto cham. tea and leek juice aa dr. 4. }
- 164 Ditto celery juice and spt. nit. aa dr. 3. } dissolved and clear.
- 165 Ditto leek juice dr. 6. }
- 166 Ditto cham. juice dr. 6. spt. nitr. dr. 1. } dissolved and clear.
- 167 Ditto cham. tea oz. 1. }
- 168 Wild cham. tea oz. 1. } dissolved to a fludge.
- 169 Gr. 10. freestone in each phial, was not affected by spt. nitr. spt. fal. cham. leek, or celery juices; nor with warm water and spts. of nitr. salt or vitriol.
- 174 Gr. 8. pebble stone, warm water dr. 4.
- 175 Gr. 6. unburnt limestone, spt. nitr. dr. 1. } ferment, and a hard calx.
- 176 Ditto spt. fal. dr. 1. } hot ferment, and soon dissolved.
- 177 Ditto lemon juice dr. 2. } part dissolved, rest hard, clear.
- 178 Ditto both vinegars each dr. 2. } no effect.
- 180 Burnt limestone, spt. nitr. vol. fal. } dissolved with heat and ferment.
- 181 Both vinegars and lemon juice. } 2d art. dissolved some part of it.



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| <p>182 Calculi dr. i-half, wild cham. tea oz. 1.<br/>         183 Ditto last tea oz. 1. soap lees gutt. 40.<br/>         184 Ditto tea ditto oz. 1. lees gutt. 40.<br/>         185 Ditto mullein tea oz. 1.<br/>         186 Ditto ditto tea oz. 1. lees gutt. 40.<br/>         187 Ditto ditto tea oz. 1. lees gutt. 40. spt. nitr. gutt. 40.<br/>         188 Ditto hollyoak leaf tea oz. 1.<br/>         189 Ditto ditto tea oz. 1. lees gutt. 40.<br/>         190 Ditto ditto tea oz. 1. lees gutt. 40. spt. sal. gutt. 20.<br/>         191 Ditto wild mallow oz. 1.<br/>         192 Ditto ditto tea oz. 1. lees gutt. 40.<br/>         193 Ditto ditto tea oz. 1. lees gutt. 40. aq. fort. gutt. 20.<br/>         194 Ditto cham. juice oz. 1.<br/>         195 Ditto ditto juice oz. 1. spt. salt. gutt. 15.<br/>         196 Ditto oyster lime water, lees gutt. 40.<br/>         197 Ditto 1st lime water oz. 1. lees gutt. 40.<br/>         198 Ditto 2d lime water oz. 1. lees gutt. 40.<br/>         199 Ditto 1st lime water oz. 1. lees gutt. 40. spt. sal. gutt. 20.<br/>         200 Ditto mullein tea oz. 1. oyster lime water dr. 4.</p> | <p>From No. 182 to 200, were mixed, Sept. 19, 1756. and on Oct. 29. No. 188, 189, and 191, were very foetid; but the calculi hard and firm in all, though the strong soap lees were added, and they had at several times stood 48 hours in the oven in the former heat. From No. 32. to 124. were mixed up in August 10th, 11th, 12th, and were set thrice in the oven of the above heat, 14 hours each time.</p> |
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| <p>201 Lees dr. 4. fluors half dr.<br/>         202 Ditto pyrites gr. 30.<br/>         203 Ditto flint gr. 30.<br/>         204 Ditto forest pebble gr. 30.<br/>         205 Ditto pebble stone gr. 30.<br/>         206 Ditto sandy pebble, gr. 30.<br/>         207 Ditto stalactites gr. 30.<br/>         208 Ditto petrifications gr. 30.<br/>         209 Ditto chalk, gr. 30.<br/>         210 Ditto limestone gr. 30.</p> | <p>From Nov. 5, to Feb. 15, all were undissolved and not in the least affected; though set several times in the oven. Dec. 1, 1760. the mixtures from 212 to 228 were put up.</p> |
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| <p>212 Gr. 12. mulberry calculi (long laid in acids)<br/>         213 Ditto lees dr. 2.</p> | <p>No. 222, 224, 226, 228, 230. had only lost 4 grains out of</p> |
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- 214 Unburnt limestone, gr. 14. lees dr. 2. 54; and 223, 225,  
 215 Burnt limestone, gr. 12. lees dr. 2. 227, 229, 231, had  
 216 Calculi gr. 12. warm water oz. 1. only lost 8 grains out  
 217 Ditto gr. 12. warm water, oz. 1. of 58, of broken, soft,  
 218 Ditto aq. calcis, dr. 5. mealy calculus.  
 219 Ditto aq. calcis dr. 5. lees gutt. 40.  
 220 Ditto oyster lime water oz. 1.  
 221 Ditto oyster lime water dr. 5. lees gutt. 40.  
 222 Ditto lime water dr. 5.  
 223 Ditto lime water dr. 5. lees gutt. 40.  
 224 Ditto oyster lime water dr. 5.  
 225 Ditto oyster lime water dr. 5. lees gutt. 40.  
 226 Ditto 1st lime water dr. 5.  
 227 Ditto 1st lime water dr. 5. lees gutt. 40.  
 228 Ditto 2d lime water dr. 5.  
 229 Ditto 2d lime water dr. 5. lees gutt. 40.  
 230 Lees oz. 1. hard calculi undissolved in acid spirits, gr. 24, part  
     turned to a gritty sand, part to a hard calx.  
 231 Lees oz. 1. soft calculi not dissolvable in acids, gr. 24. a  
     little soft, though hardish and black.  
 232 Hard calculi in 213, 217. spt. fal. dr. 2. water dr. 6. dis-  
     solved not, but crumbled between the fingers.  
 233 Gr. 24. hard calculi out of lees, ol. vitriol dr. 2. not dissolv-  
     ed, but turned to soft clayey matter.  
 234 Gr. 10. other hard calculi taken out of lee undissolved, ol.  
     sulph. turned to soft clayey substance.  
 235 Small, soft, dry calculi, gr. 10. out of numbers 222, 224,  
     226. ol. vitriol. dr. 2. in two nights turned jet-black and  
     thick, some not at all dissolved.  
 236 Spt. fal. dr. 3. calculi out of 223, 225, 227. spt. nitr. dr. 2.  
     all dissolved in three hours, in the heat of 100 degrees.  
 237 Spt. nitr. fort. dr. 3. calculi from }  
     No. 222, 224, 226. }  
 238 Spt. nitr. fort. dr. 3. calculi from } a mere sludge or slime.  
     223, 225, 227. }



These experiments were intended to have been prosecuted much farther had not want of more calculi and other necessaries prevented. This prosecution might have contributed not only to the discovery of more easy and safe solvents of the stone and other tephaceous substances in several parts of living bodies, but to many other useful purposes in life. For hereby the nature of the calculus had been best understood, and to what natural bodies they had been most similar or dissimilar; and how it was generated, encreased, or regenerated in the body, and how to be prevented. But from the above table, observe,

1. That heat, smoak, foaming, and fermentation of the calculus with acid spirit, shews a strong alcali in the calculus.

2. That where this ebullition happens, the calculus is certainly dissolved (as 15, 18.)

3. The different effects acids have on the calculus, with some it turns hard and black (38, 112.) some moulder it down to sand (32), others turn it to a white dry calx, as if calcined (43, 47, 48, 84, 101, 102, 109, 110, 111, 121, 175.) Some change it to a mere gritty sludge (36, 91.)

4. That neither salt of tartar and warm water, nor chamomile juice alone, affected the calculus,

calculus, but salt of tartar and wild chamomile juice dissolved a piece of a hard one (11, 12, 19, 20.)

5. Neither lime waters alone nor chamomile, set either in heat or cold, are entitled to the name of solvents of the stone in the bladder (1 to 12.)

6. That the mineral water salts, with lime water, and wild chamomile juice, dissolved the stone, when the first and third did not without the second (24, 25.)

7. That strong spirits of nitre or salt, lowered with wild chamomile juice, dissolved the stone better than when they are used alone.

8. Wild chamomile tea dissolved the soft calculus, which garden chamomile could not do (167, 168.)

9, 10. Sometimes the acid may be overcharged with such a quantity of calculus as it cannot dissolve, but readily dissolves a lesser (13, 14, 16, 17).

11. Of all the lapideous matters tried, calculus, stalactites, white spar, and petrifications seem most of a nature by these experiments; compare 14, 16, 43, 45, 126, 38, 46, 27, 47, 40. but stalactites and calculus as they agreed in the last numbers, so they differed in 41, 42; 50, 51, 35, 44. Though calculus  
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and fluors agree in 39 and 75, yet they differ widely in 33, 34, 35, 36, 37, 70, 71, 72, 74. Calculus and white spar agree in 16, 33, 34, 35, 36, 38, 40, 109, 110, 111, 112, 113, and differ in 41, 42, 107, 108, for spirits of nitre, salt and sulphur, oil and spirit of vitriol, soften or dissolve most of them. Vinegars dissolve only stalactites and white spar, but neither calculi nor petrifications. Lemon juice dissolves not either calculi or stalactites, but petrifications and white spar. Vinegars nor spirit of salt affect not water spar. Spirit sulphur and ol. vitriol. affect not stalactites, though they dissolve white spar. Spirit sal. and aq. fort. alter not petrifications, nor do vinegars or spirit sal. change water spar.

12. Chalk is quickly dissolved by both vegetable and mineral acids (121, 122, 123, 124).

13. Spirits and juices, poured on the calculus in a few instances, projected most beautiful green saline efflorescences, when let stand in a place some days unmoved, the liquor is clear, and a sediment at bottom, and this sometimes both with hard and soft calculi.

14. That vegetable acids of themselves seem to be no solvents of the stone, suppose the bladder could bear them, though they do dissolve testaceous and tephaceous substances.

15. Spirit

15. Spirit of sulphur, ol. vitriol. lemon juice, did none of them dissolve the stalactites (44, 46, 49.) but strong spirits of nitr. salt and vitriol. aq. fort. and vinegar dissolved them (43, 45, 47, 48, 50).

16. Both mineral and vegetable acids dissolved calcined oyster shells (52, 53, 54, 57, 58, 59, 60).

17. Neither mineral nor vegetable acids affected a hard, red, forest pebble, except spirit of vitriol (65.) and only aq. fort. and vinegar affected fluors (75, 78).

18. Aq. fort. spirits of sulphur and vitriol, and vegetable acids, dissolved, softened, and wasted the pyrites (80, 83, 84, 85, 86, 87.)

19. None of them affected a gritty pebble stone, though ol. vitriol. softened a sandy pebble (90).

20. Neither mineral nor vegetable acids affected a clear flint (93 to 100).

21. Strong spirits of nitre, vitriol and lemon juice, all dissolved pure white, fine grained petrifications (101, 102, 104, 106). But spirit sal. aq. fort. and vinegars did not.

22. White spar dissolves in spirits of nitre, salt and sulphur, and in ol. vitriol. lemon juice and vinegars, chalk in vegetable acids and spirit of salt (109, to 124).



23. Free-stone dissolved in warm water and spirit nitre only ; but this had no effect on a pebble stone. Unburnt limestone fermented much with spirits of nitre and salt, and was soon dissolved ; some part of it also dissolved in lemon juice : it was much the same with burnt lime stone (160, 173, 175, 176, 177, 180, 181.)

24. Calculus, kept seven weeks in warm water, softened not ; but gr. 10. of another piece in spirit of sal. lost seven grains in that same time (125, 126).

25. An ounce of arsesmart tea, and dr. 1. of spirit nitre dissolved 10 grs. of calculus in a week. Wild chamomile tea, and a slippery decoction of althæa root, with that spirit, did the same ; and also with spirits of salt, sulphur, and aq. fort. But spotted arsesmart tea, parsley and hollyhock teas with spirit sal. had no effect. Wild chamomile tea or juice with spirits of salt, sulphur or aq. fort. were good solvents ; and so wild mallow tea or juice, with spirit of salt. Wild chamomile tea or juice was more successful than garden chamomile, with spirits of nitre, salt or aq. fort. than with the other acids (15, 18, 25, 52, 131, 140, 151, 166, 12, 19, 25, 164, 168).

26. Cha-

26. Chamomile, althæa, mallows, mullein, being emollient, are better than warm water, arsefmart, leek, or celery juices, or teas, or parsley, the last four being stimulants.

27. The same articles and quantities neither succeed alike at all times, nor in the same time, but sometimes succeed in a shorter or longer time, at other times not at all, (12, 13, 17, 15, 19, 26, 33, 96.)

28. From a drachm and a half of calculi dissolving in oz. 1. ls. of strong lees in eight hours, in a heat from 90 to 120 degrees, and not in 48 hours in the cold (201) we see the advantages of warmth along with a course of lithontriptics; and also the great quantity of lees necessary for dissolving the stone, and the patience required to go through a course both for cure, and to prevent its return when cured, and the harm that may accrue to the constitution from too long, necessary and liberal use of lees. For we have seen that none of the infusions, juices or lime waters, with a small quantity of the lees, answered any purpose as solvents (181 to 212), though all the lees were strong, especially from 202 to 212.

29. Those of the mulberry calculus, which had laid long in former mixtures, and taken out undissolved and put into lees, some of

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them



them lost considerably. Hence in a course of lithontriptics, would not an alternate use of acids, or the mineral water salts and alcalis, be of use to expedite the cure with more ease and safety to the patient? This is yet more probable from,

30. Both hard and soft calculi taken out of the alcalis undissolved (213, 217.) put into spt. sal. turned soft, liquified, and some part turned gritty, and crumbled between the fingers. These again out of the lime waters, (222 to 229.) put into spt. nitr. dissolved to a sludge or slime. These in 236 were all dissolved in spts. of sal. nitr. sulphur or vitriol.

31. See the effects of spts. of nitr. and salt on a hard calculus alone, and with chamomile and celery juice (151 to 160.)

32. From 159 to 169 see the effects of chamomile, leeks and celery juices in a soft calculus, and their insufficiency without other helps.

33. Marcianus Africanus says, a spoonful of calcined hare skin in ashes, drank in a glass of wine on going into a warm bath, certainly dissolves the stone in the bladder; to prove which, he desires any person to pour a glass of this mixture on a river pebble stone, and it will soon dissolve it. This was tried, given in  
a strong

a strong jelly of hareſkin with white wine; it answered the expectation of the experimentor, but not of the boasting promiſer, viz. not at all.

From theſe ſeemingly trifling experiments, perhaps ſome uſeful hints may be gleaned.

As, 1. That it is not only needleſs, but ſometimes ridiculous, to try ſome formerly celebrated ſofteners, breakers, and diſſolvents of the ſtone.

2. That in ſeveral places of Africa, and other hot countries, where they live moſtly on milk and vegetables, which are of an aceſcent nature, they might be leſs liable to the ſtone, and their ſtones, being ſofter, might ſooner and eaſier be diſſolved, than from a fleſh diet, which produces a much greater alcali, both to promote the generation, firmneſs, ſolidity, and inſeparability of the ſtone.

3. Of the mineral acids, ſpirit of nitre, ſalt, and oil of vitriol were the ſtrongeſt, ſpirits of vitriol and ſulphur were weaker ſolvents; and aq. fort. too cauſtic. Strong ſpirit of nitre diſſolved, ſoftened, and made fall down in a ſoft milky pulp or ſludge, or in powder, thirteen pieces of calculi of five different large ſtones; ſpt. ſal. eleven pieces; ol. vitriol, ſeven; aq. fort. (which was ſeldom uſed) four.

Oil



Oil or spirit of vitriol failed thrice; spt. nitre, thrice; spt. sal. fix times; spirits of sulphur and vitriol, each once; ol. vitriol. once; aq. fort. twice. The stronger acid spirits, as spirits of nitre, sea salt, oil of vitriol, aq. fort. but of the weaker, and vinegar, only dissolved the stalactites. Oyster-shells were dissolved both by the strong and weak, but not by the middle acids. The red, ponderous, fine grained, flinty pebble stone, was dissolved only by oil of vitriol. Fluors remained unaffected by all, except vinegar, ol. sulphur. and aq. fort. Pyrites dissolved readily in ol. vitriol. aq. fort. lemon juice, and vinegars. Flints yielded only to spirits of nitre, sulphur, ol. vitriol. and lemon juice. Petrifications dissolved both in mineral and vegetable acids. White spar is dissolved by lemon juice; water spar by spirits of nitre and salt; limestone burnt and unburnt, by strong spirits of nitre and salt and lemon juice. By comparing these experiments with acids, stalactites, and white spar, we come nearer the nature of the calculus.

5. When only sandy, gravelly matter, soft or small stones are to be expelled, methods should vary according to the constitutions, sexes, ages, habit of body, and former manner of life, &c. Thin, meagre, hectic, bilious

lious persons cannot bear acrid, irritating things, for they straiten and contract the passages, and thereby occasion either a suppression of urine or inflammations, and increase the symptoms both in number and severity; for only emollients, lubricants, relaxers and anodynes suit them; as althæa, chamomile, mallow, parietoria, mullein, poppies, &c. which should be used internally and externally. But fat, bulky, cold, phlegmatic habits require stimulants and rowzers, as horse-radish, leeks, onions, celery, parsley, arsefmart, soap-lees, &c.

6. As bilious habits would have their parts needlessly increased by such acrid, saline, heating stimulants, so neither can they endure violent exercise or motion, as shaking, jolting, hard riding, &c. without pushing the stone into the neck of the bladder, increasing the pain, threatening suppression of urine; hence a distension (if not bursting) of the bladder, inflammation, hæmorrhages, &c. But contrary habits should have and bear more and stronger exercise, and more stimulant, diuretic medicines.

7. As the fresh-drawn blood of healthy persons, is found to be neither sensibly acid or alkaline, so it may not always be adviseable to pursue too long a course, and in too often repeated



peated large doses of soap-lees ; therefore some intervals may be adviseable, or alternately to use acid or alkaline solvents or softeners, or use both together, which prevent all future harm, and assist much in forwarding the same design, since gentle acids only have cured several in less time than Mrs. Stevens's medicine, without trouble, nauseousness, or a supervening hectic, and prevented the after generation of the stone, and certainly such a mild acid there is.

8. Nor are acid or acrid solvents or diuretics at all proper, when either much sharp sand, small or large stones, or a heap of thick sludge, plug up the passage, and have caused a fever, inflammation, or hæmorrhage, before bleeding and other proper evacuations, cooling, softening, laxatives, emollients and anodynes internally and externally exhibited, both to empty the bowels and cool the body, widen the passages, and mitigate the pain.

9. Mixtures of such things as afford readily a soft, glutinous, or mucilaginous substance to the blood and juices, may be advantageously used along with the soap-lees, both to sheath up some asperities in the caustic salts, and relax and dilate the ducts and passages, and smooth the acrid juices, or be a litus on the insides of  
the

the vessels ; and so in some sort may profitably supply the want of fat or oil in the soap- lees, with this advantage, that the former turn not rancid like the latter.

10. It was before observed, that the lee soon dissolved down to slime or fludge and white powder, indissolvable by mineral acids, a parcel of calculi (201.) that were neither dissolved by the acids in the cold, or in a warm room, nor by being set several times in a warm oven all night after the bread was drawn, whereby they were rather hardened : hence it seems some stones are better dissolved by alcalis than acids ; this merits further trial, whether it will hold good in general, or in what sorts ; and if acids will harden such stones, so as they can be neither softened nor dissolved.

11. Though lees are a powerful solvent of the calculus, yet they affected not fluors, flints, pebbles, pyrites, petrifications, gretstone, free-stone, or stalactites, though they stood two months, and were several times set in the warm oven.

12. Sometimes weaker things than either caustic spirits or lees will often swell, make fall down, and bring away soft calculi, as the juice, infusions or decoctions of the above or  
like



like vegetables, or oyster-shell lime water. Such stones on trial have been found mere heaps of sand or earth loosely tacked together, soon formed, and of short abode in the body. But when their growth is slow, and they have laid long in the kidneys or bladder, their particles are small, their contacts many, and their cohesion strong and solid. The sufferers have need of great patience, strong resolution and perseverance to obtain a solution or cure, without lithotomy. There are sometimes stones in the bladder which can neither be dissolved or extracted, though soft by their lying out of the reach of medicines, as between the coats of the bladder; an instance of which I saw by being witness at opening the dead body of a man, who had died the day after being cut for the stone, where it was found very large, broad, concave on the side next the bladder, and convex next the pelvis, soft and friable. Another instance of the sudden generation of the stone in a healthy young man, who never had the least fit or symptom of it before; but was suddenly and severely seized with the piles, especially a large pendulous one, which he got tied at its small root, and had it cut; he was very easy the night after; near day the pain shifted to the bladder, and he had a severe fit of the stone;

stone; being advised to a proper course, he voided much sand and several small stones; he had no more of the piles after, but was at different times sorely afflicted with the gravel near twenty years, but it left him ten years before he died. In the case of a woman long afflicted with the most frightful distracting pains in her belly, especially about the bladder and uterus, in which her water was always taken away with a catheter, after many wearisom months of this affliction, it turned to the stone and gravel; every two or three days her water was taken away as before, and once a week the bladder was half full of calculi of various shapes, sizes, and colours. Two of these I kept two years in a drawer near a fire. When extracted from the uterus, they weighed three drachms a piece, one was like a piece of oblong red coral, and after keeping so long warm, weighed only half a drachm. Gr. 15. of this was put into weak soap-lees, and kept nineteen days in a heat from 80 to 100 degrees. This made no alteration on it. When broken it had glittering particles in it like sand, and several white streaks, and weighed the same weight when taken out. The other stone was of a blue colour like slate or indico, softish and smooth, as though it had been cut with a knife, and



and was shrunk up to half a drachm. Gr. 15. put into an ounce of lees, were not altered in the same time and heat. It was then taken out and put into a clear open fire, but came out unaltered and of bole colour. Then both calculi were put into spirit of salt several days, but were not at all affected by it; quære, were these stones of animal or terrestrial generation? After this generation of those stones shifted from the bladder to the uterus, where six or seven large ones, besides several small ones, were extracted every second or third day.

13. Some calculi are far sooner and more easily dissolved than others. Of the latter sort are hard, fine grained, brown, knobby, compact, and angular kind, such as the mulberry stones. Of the former are the white, soft, tephaceous, mouldering, sandy, granulating kind, whose contents and cohesions are slighter and less. Two of the last sort were used in these experiments; one in its solvents fell down in a coarse running sand; the other in a thick, puddly, slimy sludge; having in their composition, besides the calcarious matter, much viscous glutinous juice, like that in horns, hoofs, nails, &c. which give a strong conglutinating cement. There are also viscous, jellied urines, like shot-star.

14. Though

14. Though it is difficult to tell whether the calculus in a living body is hard or soft, easy or not to be dissolved, yet some idea may be formed of it. If the distemper suddenly attacks a healthy person not formerly liable to it, or if liable, if he has had short intervals before; if he has voided much sandy, gravelly matter in his urine, or small soft stones that crumble between the fingers; if the fit seizes quickly without any previous notice; if the urine smarts and heats the urethra much in coming off, and, when stood and cold, lets fall much red and white sand, which when the urine is heated again dissolves not, or washed in clear water (when the urine is poured off) falls soon to the bottom; or if the person is gouty, and has had several tophaceous or chalky knobs on his extremities: These signs indicate a soft stone, and the contrary a hard one, especially if in the bottom of the urine lies much clear, glaring, tough, glutinous or slimy matter.

15. Since from the above experiments the stalactites and white spar, of all petrified or concrete substances, come nearest to the nature of a human calculus, though all the calcareous tribe have some analogy to it; then,

I. The inquiry after a dissolvent of the

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stone



stone is brought within a narrower compass when we know to what the calculus bears the nearest affinity. Solvents of the several kinds of stalactites, white spars, and other calcareous bodies, may be sought after, whether they are more solid or spongy, hard or soft, stony or tophaceous, as we meet with several sorts of them, as well as various kinds of calculi in the body ; as those of the gout, liver, bladder, &c.

2. As the white porous stalactites and spars are not to be found in or near an alkaline earth, so the generation of the calculus is from an alkali in the blood, however insensible it is in a healthy state.

3. Then examining carefully the sediments of the urine with dissolvents of stalactites and spar, may give us some more light into the nature of the stone and its proper solvent, as neither all calculi nor all stalactites and spar are alike.

4. The violent fermentation of a few of the calculi, with some of the mineral acids, and their forming saline efflorescences and stiriæ of nitre, shew plainly an alkali or absorbent earth in some calculi, and hints that perseverance in a long course of drinking in the spring

spring some proper acidulæ are better than soap or lees.

In 1741, Scacher published a piece to shew the advantage of the Caroline Bath water for the stone in the kidneys and bladder. And in 1749, Dr. Springfield, in his small treatise on those baths, mentions an instance in which the waters dissolved a stone in the bladder; and promised, at a more convenient time, to make some farther trials of them. Accordingly, in 1756, he published a dissertation, wherein it appears to him and Dr. Liekberkult, that the water of those baths was superior by six degrees to fresh, calcined egg-shell lime water, though the latter actually possesses a lapidescent quality, as it contains alkaline salt and calcarious earth. But if the Doctor had rightly understood his subject, he must have taken in iron, though not vestigable, which it was impossible to discover mixed with the above two ingredients, which mostly envelope and hide it. How many instances have we of simple chalybeate waters dissolving and bringing off calculous matter, and effectually preventing its generation in abundance of subjects? And moreover, it is only a kind of soft, mouldering, tephaceous calculi, that either these or lime



waters will dissolve, and an infusion of wild chamomile tops will sometimes dissolve such. That these waters reduce the hardest cheese to a soft pulp, is most probable; for very weak soap lees, such as may be drank, will do the same, yea more, reduce much of it to a thin, white milk, by standing some time in a heat of ninety-six degrees. Dr. Springfield says, Though these waters dissolve the stone in the reins and bladder, and the stony incrustations on the teeth, yet they dissolve not stones in the gall bladder, but rather incrustate them. From weak lees dissolving hard cheese, we see the expediency of giving soap along with solid, strong, tenacious substances, to promote their easy digestion on the stomach.

16. From the puddley sludge in the phials with the solvents, it appears that in a course of Mrs. Stevens's medicine, soap or lees, the calcarious matter voided by urine, is not the alkaline part of the medicine; for they, being a fixed salt, continue fixed in the fire, and ferment strongly with acids, as vinegars, lemon-juice, acid spirits, &c. but not the former, which the fire renders partly volatile.

17. Before any solvents for the stone in the bladder are used, it is necessary to be satisfied that

that there is a stone there, and that a want of secretion, or stoppage of urine, arise not from an inflammation of the kidneys, bladder, or a spasm of the sphincter vesicæ, or some carnosity, excrescence, schirrus, fungus, &c. in the passages, and that the case is not colical instead of nephritic pains.

15. Inflammations of the kidneys are known from a heat, feverishness, thirst, quick pulse, high-coloured urine, vomiting, and pain in the kidneys; a weight, heaviness, and pulsation, are perceived in those parts, which are increased by sneezing, or any other violent motion; the person affected can neither with ease stand upright, or lie on the afflicted side but with pain; he feels a numbness on the leg and thigh of that side. If the bladder or its neck are inflamed, there is a pain at or above the pubis, with a sensible heat and pulsation there, and in the parts themselves, a stoppage of urine (except by drops or dribbling) and often a tenesmus or costiveness. If there are ulcers in the kidneys or bladder, they are perceived by purulent matter mixed with the urine, or pus and blood; it is more immediately mixed with the blood in the former than in the latter, whereby it is made more crude and separated,  
and



and the pain discovers the seat of the ulcer. But in an ulcer in the neck of the bladder, the pus lies pure and unmixed in the urine, and the long continuance of pus in the urine shews certainly an ulcer. In an ulcer of the bladder, the pain and difficulty of making water continues, but in the reins they come by fits. Fungi, excrescences, schirri or carnosity in the urethra, are discovered by the catheter and fingers, and a duration of the stoppage of water. Though there is a great resemblance between nephritic and colical pains, yet their difference may be discovered. In the latter the pain is above the kidneys, and shifts places through the whole intestines, and the vomiting is more severe. In the former there is often red sand or gravel in the urine, the pain is fixed, keeps its place, and tends outwards; there is also a weight and dull pain, which prevents bending backward or forward easily; the sick are better after eating in the former case, but in the latter they are worse.

18. That there is a stone in the kidneys is known from a constant fixed pain in the loins, its feeling heavy and like a weight, with a dull sense of it, and bending the back being uneasy. There is a heat in the loins, a numbness

ness in the thigh and leg of the pained side, and a retraction of that testicle. If the stone is large, shake, moved or sharp, then sudden motion, jolting or exercise, cause great pain and bloody urine. In the beginning of the disease the urine is often scanty, pale, and clear as water ; but when the stone enters the head of the ureter, the pain is sharp, tearing, and almost intolerable ; but when it has passed the ureter, and fallen into the bladder, the pain abates, the urine is thick, turbid, and much in quantity. A stone is known to be in the bladder from the pain in making water, and often by little and by drops, and sometimes tinged with blood, if the stone has sharp edges or angles. It has often sand in it, and the upper part of the præputium is red and inflamed. The sick, children especially, are often pulling their genitals, and the penis is often erected. They have a constant desire to make water, followed by a sharp pain in the glans. If the stone is large there is a weight and heaviness in the perinæum and region of the groin, and an inclination to go to stool when they make water, with sometimes a prolapsus ani. If the stone is in the urinary passage, they often sit cross-legged, or on the  
edge



edge of a seat. The stone may be felt there by the finger or catheter; and the water is stopped; and when there is a stone in the bladder, they make water better in an horizontal than an erect posture.

F I N I S.

















